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Quarterly

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QUARTERLY

of the

NATIONAL FIRE PROTECTION ASSOCIATION

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Accounts of fires appearing in the Quarterly are copies of or extracts from reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

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Acme

Two 96-year-old flour mill buildings that had withstood the burning of Richmond, Va., April 18, 1865, were destroyed on March 23, 1949 by fire believed caused by foreign material in a wheat grinder. Delayed detection, tremendous areas, large quantities of dust and the many vertical openings necessary for the operation of a flour mill accounted for the rapid spread through the unsprinklered building of origin. An adjoining structure was involved when flames burned around the intervening fire wall and entered through plain glass windows. Loss is estimated at $1,000,000.

The Quarterly

Vol. 42 April, 1949 No. 4

Meeting of Board of Directors

New York, Thursday, January 27, 1949

Present

George W. Elliott, Chairman
John L. Wilds, President
A. H. S. Stead, Vice-President
Hovey T. Freeman, Secretary-Treasurer
C. W. Pierce, Past President
Richard E. Vernor, Past President

Malcolm S. Blake
A. L. Brown
Hylton R. Brown
Loren S. Bush
A. L. Cobb
Jack C. Curtis
John Kidde
R. D. MacDaniel
Frank C. McAuliffe
John A. Neale
H. E. Newell
George J. Richardson
W. A. Ross

Percy Bugbee, General Manager
Robert S. Moulton, Technical Secretary
Horatio Bond, Chief Engineer
Charles S. Morgan, Engineer

Business Transacted

1. On behalf of the Program Committee, General Manager Bugbee reported on plans for the 1949 annual meeting and the Program Committee was authorized to proceed accordingly.

2. It was voted to hold the 1950 annual meeting of the Association at Haddon Hall, Atlantic City, N. J., May 15-18.

It was voted to authorize the General Manager to make arrangements for a meeting in Detroit, May 7-10, 1951, and to make tentative arrangements for a meeting in Montreal in 1952.

3. Treasurer Freeman reported on the finances of the Association and on his motion it was voted to authorize the transfer of funds now designated as Field Service Reserve to the General Reserve.

General Manager Bugbee announced a gift of $10,000 to the field service fund from the Federation of Mutual Fire Insurance Companies.

4. Staff reports on the following subjects were received with expression of appreciation to the staff for their various activities:

(a) Membership.
(b) General Publications.
(c) Inspection Manual.
(d) Advertising.
(e) Fire Marshals' Section.
(f) Electrical Field Service.
(g) Public Relations Activities.

5. The holding of two regional meetings in the fall of 1949 was approved and the staff was authorized to proceed with arrangements for meetings in the Northeast and in the South.

6. It was voted to establish a policy of annual awards or citations to members who have rendered distinguished service to the Association and to instruct the staff to submit a detailed proposal for action by the Board at a subsequent meeting.

7. A proposal from the Fire Extinguisher Manufacturers Association for NFPA field activity in organizing state associations of industrial fire brigades was discussed and referred to the Committee on Firemen's Training for further investigation and report to the Board.

8. A report from the Special Committee on Fire Protection Engineering with relation to the action that the Association

openings involved when flames burned around the intervening fire wall and entered through plate glass windows structure was involved $1,000,000.

might take to promote the recognition of fire protection engineering as a profession was accepted in principle with a vote of appreciation to the committee, and the committee was requested to consider the matter further in the light of the discussion at the Board meeting and submit detailed proposals for Association action to establish the qualifications of members in the field of fire protection engineering. (This report is printed as Appendix A of these minutes.)

9. The report of the Committee on Technical Committee Procedure was approved with action as follows:

(a) The following report on committee reorganization was accepted:

Substantial progress has been made in putting into effect the various committee reorganizations authorized by the Board at its last meeting. We still have under consideration various additional changes in committee set-up which it may be desirable to recommend at a later date, but we are refraining at this time from making specific recommendations, feeling that before any further changes are made time should be allowed to get the NFPA committee structure fully adjusted to the changes already made. In general, it appears that the committee members and others interested are satisfied that the changes already made are in the interest of more efficient operation.

We now have 60 technical committees with an aggregate membership of well over a thousand. The services of the committee chairmen and members, all rendered without compensation, represent a major contribution to the cause of fire safety. Correlation of the activities of the various committees, handling their reports and other details of administration, constitutes an important part of the NFPA staff activities, and additional committee projects or reorganization of existing projects must be planned with due consideration to the facilities of the NFPA staff.

(b) The committee reported receipt of a communication from the National Electrical Manufacturers Association recording certain objections to the new procedure for revising the National Electrical Code and expressed the opinion that if the new set-up for revision of the National Electrical Code is approved by the American Standards Association (see Minute No. 10(a) these objections should be satisfied, and also called attention to certain action already taken by the Electrical Correlating Committee which met in part the NEMA suggestions.

(c) It was voted to withdraw from the American Standards Association the NFPA Standards on Piping and Fittings for City Gas, edition of 1932, that no present action be taken towards submitting the current edition of these standards to the ASA, and that the NFPA will not participate officially in ASA committee Z-21. The recommendations of the Committee on Technical Committee Procedure on this subject were as follows:

In 1932 we submitted the then current edition of our Standards on Piping and Fittings for City Gas (NBFU Pamphlet, No. 54) to the American Standards Association for approval. This was done largely as a gesture to maintain NFPA prestige in the field of fire safety standards for gas installations. At the time the ASA had already approved as American Standard several competing or overlapping codes, one sponsored jointly by U. S. Bureau of Standards and two gas associations, and several dealing with the installation of various types of gas appliances sponsored by the American Gas Association. The NFPA standard was duly approved by the ASA as an existing standard and is still listed as an ASA standard.

In 1943 the NFPA adopted a complete revision of the 1932 standards on recommendation of the Committee on Gases. The 1943 revision was not submitted to the ASA to supersede the prior standard, as it should have been under ASA procedure, primarily because the wartime load on the NFPA office was so great that we did not feel justified in diverting attention from vital war matters to devote the very considerable time that apparently would have been necessary to deal with the technicalities of submitting the revised standard.

The original standard had been submitted as an existing standard. The usual ASA procedure in such cases would call for submitting revisions under the sectional committee method. This would have entailed the organization of a new committee or reorganization of the NFPA Committee on Gases to comply with the requirements for ASA sectional committees. There was some doubt as to whether this would be desirable in the absence of any clear-cut understanding as to the status of NFPA committees which have been qualified under ASA sectional

committee procedure. We consider such committees as primarily NFPA committees and do not feel that having the personnel of an NFPA committee approved by the ASA changes the status of the committee in respect to our responsibilities or control. However, there seems to be a considerable body of opinion to the effect that any sectional committee operating under ASA procedure is essentially a committee of the ASA rather than a committee of the sponsor body and that the ASA has responsibility and control and can, if desired, take the committee out of the hands of the sponsor and adopt as standards reports prepared by the committee even though the sponsor does not approve. While probably nothing of this kind would happen in practice, the uncertainties of the situation have made us loath to recommend constituting additional NFPA committees under the ASA sectional committee procedure.

We now have a request from the American Gas Association that the NFPA withdraw the 1932 standard which was approved by the ASA in 1933. The American Gas Association has stated their intention to revise their Requirements and Recommended Practice for House Piping and Appliance Installation, edition of 1940, and submit it to the ASA for approval as an American Standard. They also state that they will submit revisions to the NFPA Committee on Gases for possible incorporation in the NFPA Standards on Piping and Fittings and City Gas. The American Gas Association has already submitted to the ASA over 30 standards dealing with the installation of various types of gas appliances.

We recommend that the 1932 standard be formally withdrawn from the ASA and that no present action be taken towards submission of the 1943 edition. We further recommend that the NFPA should not participate officially in the ASA sectional committee Z-21, thus avoiding any direct or implied commitment to have our standards conform with standards approved by the ASA. We do not anticipate any difficulty in respect to securing reasonable correlation or uniformity of standards, as the atttitude of the American Gas Association is fully cooperative and we can presumably count on them to submit their recommendations for changes in standards to the NFPA Committee on Gases for consideration prior to any final ASA action.

(d) It was voted to submit to the American Standards Association for approval as American Standard under the proprietary sponsorship method the current Standards on Blower Systems upon completion of action on revisions now under consideration by the Committee on Blower Systems. The report of the Committee on Technical Committee Procedure on this subject was as follows:

The revisions in the Standards on Blower Systems now under consideration by the Committee on Blower Systems will, after adoption, be the final step in NFPA action on a complete new edition of the Standards on Blower Systems. The last complete edition of these standards issued in 1937 was submitted to the American Standards Association and approved as an American Standard in 1938 under the proprietary sponsorship method. The proprietary sponsorship method differs from the sectional committee method in that the sponsor organization has complete control over the personnel and procedure and ASA approval is contingent only upon submission to the ASA of evidence satisfactory to them that the standard represents a national consensus and is suitable for approval by the ASA. We recommend that the new edition of these standards, after adoption, be submitted to the ASA for approval under the proprietary sponsorship method to supersede the edition of 1937.

(e) The Committee on Technical Committee Procedure reported that the desirability of referring certain standards developed through NFPA procedure to ASA for approval is fully recognized, and nothing in this report should be construed as contrary to this view. The committee stated that it will study this entire subject of policy relationship, and, after conferences with ASA officials, will report its recommendations to the Board.

10 (a). It was voted to approve a report from Chairman Alvah Small of the Electrical Section submitting for confirmation by the Board the Procedure for handling revisions of the National Electrical Code as developed by the Electrical Correlating Committee and the personnel of the Code-making panels in accordance with the prior action of the Board in establishing the Electrical Section which called for confirmation by the Board. It was further voted to submit the Procedure and personnel of the panels to the American Standards Association for approval as a preliminary to submission of the next re-

vision of the National Electrical Code to the ASA for approval as an American Standard. (This Procedure is printed as Appendix B of these Minutes. The personnel of the panels appears in the 1948 Year Book; revised lists will appear in subsequent publications.)

10 (b). It was voted to establish the membership of the Electrical Section and voting privileges therein as follows:

Membership

(a) Any associate member who signifies his desire to be enrolled, but only one Section member to be enrolled under one associate membership.

(b) Representatives of organization members designated officially by the organization for membership in the Section, without limit as to number of representatives of one organization member.

(c) Individuals who were members or alternate members of the old Electrical Committee, in so far as they are NFPA associate members or were originally designated as representatives of organization members, without any further formal request or designation, but subject to withdrawal on request of the member.

Voting

(a) No individual may cast more than one vote.

(b) Not more than six representatives of any one organization member may vote at any meeting.

11 (a). Proposed amendments to the Standards on Blower Systems submitted by the Committee on Blower Systems in accordance with the authorization of the 1948 annual meeting were referred back to the committee for clarification of details about which questions had been raised, with the suggestion to the committee that after securing agreement on these details the amendments may appropriately be submitted to the 1949 annual meeting for action.

11 (b). It was voted to confirm the action of the Board by letter ballot approving amendments to the Recommended Regulatory Standard for Tank Vehicles for Flammable Liquids submitted to the Board by the Committee on Flammable Liquids in accordance with the authorization of the 1948 annual meeting.

11 (c). It was voted to confirm the action of the Board by letter ballot approving revisions in the Standards on Liquefied Petroleum Gases at Gas Utility Plants and the Standards on Liquefied Petroleum Gases as submitted by the Committee on Gases in accordance with the authorization of the 1948 annual meeting, subject to editorial changes by the chairman of the committee.

12. A communication from the American Standards Association requesting comment on a proposed international standardization project in the field of fire fighting equipment was discussed and the staff was instructed to communicate with the American Standards Association questioning the desirability of proceeding with the particular project proposed at the present time and advising the ASA along the lines of comments registered in the discussion.

13. A proposal for change in the name of the Association was tabled.

14. On recommendation of the Committee on Technical Committee Procedure, it was voted to confirm the various committee appointments authorized by the Board at its last meeting and recorded in the 1948 Year Book, also to confirm additional committee appointments as submitted to the Board at the meeting.

15. A communication from Chairman Alvah Small of the Electrical Correlating Committee was considered and it was voted to advise the committee that the action of the Board of Directors in 1946 setting aside certain provisions in the National Electrical Code pertaining to the so-called Type S fuse was not intended to estop subsequent consideration of this subject and that the Electrical Section, the Correlating Committee and the Code-making panels are free to consider this entire subject further and make any desired recommendations for Association action without regard to prior action by the Board.

16. On recommendation of the Committee on Places of Outdoor Assembly, it was voted to approve a change in the scope statement for the committee to permit it to consider certain types of grandstands installed in buildings in addition to outdoor grandstands.

17. Board Member Frank McAuliffe reported on developments in civil defense planning and was thanked by the Board for his informative statements on this subject.

Appendix A

Report of Special Committee on Fire Protection Engineering

The Special Committee on Fire Protection Engineering met in Chicago on December 7, 1948, with all members present to consider the professional status of Fire Protection Engineers, and to report to the Board of Directors recommendations as to the action the Association should take to promote recognition of this field of Engineering. The Committee arrived at the following conclusions.

1. Fire Protection Engineering is a profession because the ethics, knowledge, responsibility to the public and requirements of practice are on a professional level and the work done meets the requirements of professional work.
2. State Boards of Engineering Examiners do not recognize Fire Protection Engineering as a profession. This lack of recognition is due primarily to the fact that there has been no organized promotion of this field such as has taken place in other engineering fields, through the efforts of the various Founders Societies.
3. A need exists for recognition of Fire Protection Engineers as provided in other engineering fields by their founders societies.
4. Proper recognition of Fire Protection Engineers by a duly qualified certification authority would result in increased recognition by City and State Officials, Architects, Civil Engineers and other professional engineering groups who are in need of the information which Fire Protection Engineers could provide on fire hazards, safety to life and preservation of property.
5. Lack of minimum standards for Fire Protection Engineers has been an obstacle in obtaining recognition by State Boards of Registration and Federal Manpower Authorities.

Recommendations: Based on the above conclusions the Committee submits the following recommendations to the Board of Directors of the National Fire Protection Association for their consideration.

1. The National Fire Protection Association should establish a program whereby members properly qualified may be certified as Professional Fire Protection Engineers.
2. This certification could be accomplished through a committee which would establish minimum professional standards similar to those of the founders societies and acceptable to the National Council of State Boards of Engineering Examiners.
3. Any means that may be provided for certification of proficiency in fire protection engineering should be established under the sponsorship of the National Fire Protection Association and under the control of its Board of Directors.
4. This certification should not result in a special class of membership in the National Fire Protection Association, but any member of the Association who desires certification may make application if he feels so qualified.
5. This program will concern itself with efforts to improve the status of Fire Protection Engineering as a profession. Such certification will help to raise the proficiencies of the Fire Protection Engineers in a similar manner to that which is now being accomplished by the Certified Property and Casualty Underwriters examination program. The certified members can become recognized as the founders group of Fire Protection Engineers which can develop a closer relationship, better understanding and increased recognition from other professional engineering societies.

John J. Ahern, *Chairman,*

Warren J. Baker, Carl G. Richmond,
A. L. Cobb, W. G. Schultz,
John A. Neale, Elmer F. Reske.

Appendix B

Rules of Procedure of the National Electrical Code Committee

Electrical Section, NFPA

The National Fire Protection Association, as sponsor of the National Electrical Code, has organized an Electrical Section. One function of the Section is to provide opportunity for presentation and discussion, in open meeting, of proposals for revisions of the Code. In addi-

tion, proposals may be filed by members of the Section or by the public with the Secretary of the Section and its Correlating Committee.

Regulations of NFPA

The activities and program of the Electrical Section are subject to the regulations for Sections of the Association.

Membership of the Section

Membership in the Electrical Section is open to any associate member of the Association and to designated representatives of an organization member.

Meetings of the Section

The Section will meet annually at the time and place of the National Fire Protection Association's annual meeting (unless omitted on the request of the Section with the consent of the NFPA's Annual Meeting Program Committee). Other meetings of the Section may be held at times and places it may select.

National Electrical Code Committee

The Electrical Section reports its recommendations to the Association concerning revisions of the National Electrical Code which have been proposed by the National Electrical Code Committee of the Section.

The functions of the Committee are:

A. Interpreting provisions of a current edition of the National Electrical Code, including Supplements.

B. Handling proposals for Tentative Interim Amendments of a current edition of the National Electrical Code, including Supplements.

C. Developing, periodically, revised editions of the National Electrical Code, including Supplements.

The National Electrical Code Committee consists of:

1. A Correlating Committee, and
2. A number of Code-making Panels.

Correlating Committee Membership

The membership of the Correlating Committee shall be appointed by the Board of Directors of the National Fire Protection Association. The Board also appoints the Chairman of the National Electrical Code Committee and of the Correlating Committee and a non-voting Secretary of both Committees.

Functions

The Correlating Committee has the following functions:

1. Determines the policies and steps incident to revising the National Electrical Code.
2. Organizes the Code-Making Panels.
3. Reviews all reports by Code-Making Panels that recommend changes or additions to the National Electrical Code and Supplements; approves them, or directs they be referred back for further study.
4. Determines upon the Approved Procedure for interpreting the National Electrical Code, or Supplements.
5. Determines the general procedure with regard to proposals for Tentative Interim Amendments of the Code or Supplements; and reviews recommendations of Code-Making Panels with respect to Tentative Interim Amendments, and, if acceptable, approves them in the name of the National Electrical Code Committee.
6. Reports to the Electrical Section and to a general meeting of the NFPA, the sponsor, its approval of a proposed new Edition, or a Supplement, of the National Electrical Code, recommending final approval as a Standard.

Meetings

Meetings of the Correlating Committee shall be held at the call of the Chairman. Seven members shall constitute a quorum. Action by the Committee approving changes in the National Electrical Code shall be on the basis of at least seven affirmative votes; provided that if any absent member registers disapproval the action must be reaffirmed by letter ballot or at a later meeting of the Committee.

Revisions of the National Electrical Code

To be approved and recommended by the Correlating Committee a revision of the National Electrical Code shall be:

A. A Tentative Interim Amendment,

B. A Supplementary Revision, or

C. A General Revision.

A. Tentative Interim Amendments—A Tentative Interim Amendment is a revision applied for and processed in accordance with the Approved Procedure for Tentative Interim Amendments.

Note: This Procedure as now approved by the Correlating Committee is, in principle, that previously in effect, in accordance with which several tentative amendments were announced by the former Electrical Committee.

B. Supplementary Revisions—A Supplementary Revision of the National Electrical Code will ordinarily appear at yearly intervals as the result of reports from one or more Code-Making Panels that recommend amendments of Articles of the Code or propose new Articles. Supplementary Revisions will be identified according to the year of their publication. Their respective contents may have further consideration when a General Revision is undertaken.

C. General Revisions—A General Revision of the National Electrical Code will be planned

according to conditions, as follows:

1. Upon the initiative of the Correlating Committee after a four or five-year interval since a previous General Revision.
2. After a shorter interval upon the request of the publishers of the Code.

Code-Making Panels

A Code-Making Panel has referred to it, considers, and reports as to its recommendations proposed amendments or revisions of the National Electrical Code. Each Panel has sponsorship of one or more related Articles of the Code.

It will be the responsibility of the Correlating Committee to provide for proper representation on the various Panels of those concerned with their respective Article assignments.

The number of Code-Making Panels and the Code Articles assigned to each shall be determined by the Correlating Committee which shall also appoint the Chairman of each Panel and the individuals formally designated to serve with him. It shall also designate alternates for such individuals when conditions seem to warrant. Groups concerned with the Articles handled by a Panel may designate a representative to serve.

Additional personnel (and alternates) may be added by the Correlating Committee following its consideration of nominations from groups that are concerned. The Correlating Committee does not expect that every group will require representation on every Code-Making Panel.

The program of each Code-Making Panel shall be directed by its Chairman as seems most appropriate for efficient disposal of the suggested revisions of the one or more Articles that are assigned to it.

Each Panel may develop its own working methods, subject to the requirement that its recommended revisions of the National Electrical Code must represent, in a major degree, the consensus of those substantially concerned with the Code Article by which the recommendations are recorded.

Technical subcommittees to consider any designated topic shall be appointed by the Chairman of the National Electrical Code Committee, if directed by the Correlating Committee or upon his own initiative. Those invited to serve on a technical subcommittee shall be chosen on the basis of familiarity with the problem or topic and need not be members of the National Electrical Code Committee. Its report, if containing proposals for changes or additions to the National Electrical Code, shall be referred to that Code-Making Panel to which the affected Article of the Code has been assigned and, if approved, shall be submitted to the Correlating Committee for further processing.

It is expected that the various Panels will each solicit from individuals or groups concerned with the scope of an Article the technical assistance and co-operation that will contribute to having its recommendations represent a consensus. Those co-operating in this manner shall have mention in the report of the Panel.

When reporting recommended revisions, the outcome of voting by the designated members of a Panel shall be recorded with the Correlating Committee by the Chairman of the Panel. This report shall advise respectively as to the number (of designated members) voting in favor or against and also those formally refraining from voting; if requested by a member, his reasons for an affirmative or negative vote or for refraining from voting shall be included in the report. The required voting record shall not include the individuals serving without having been formally appointed to membership in the Panel.

Each Panel shall report also its having given consideration to any proposals for Code changes that have been referred to it and which are not recommended.

A Panel may report at any time its recommendations for revision of one or more of the Articles which are assigned to it. These recommendations will be processed with similar reports from other Code-Making Panels by the Correlating Committee and the Electrical Section for release as an annual Supplement to the current edition of the National Electrical Code or will be included in the program for a general revision of the Code, if one is scheduled.

Method for Handling Proposed Revisions

The stages through which proposed changes in the Code are to be considered will be as follows:

1. Proposal is prepared by some person and is assigned to a Panel.
2. Panel considers and forwards to the Correlating Committee.
   2a. Panel may refer it to a subcommittee for recommendation.
3. Correlating Committee submits revisions to Electrical Section.
4. Electrical Section approves or returns it to Correlating Committee.
5. Correlating Committee may make final check for correlation.
6. Revisions reported to NFPA annual meeting.
7. NFPA acts in annual meeting, and may refer to Board of Directors.
8. NFPA submits it to American Standards Association.

Some Notes on U. S. Civil Defense

By Horatio Bond, Chief Engineer
National Fire Protection Association

Americans are likely to have strange and varied impressions of what civil defense is all about. Not only did American cities escape attack but American civil defense programs wandered far afield. A proposal to put red shirts on firemen was fortunately killed before it received official sanction, but other proposals got by. It would be hard to visualize civil defense as a life-and-death business, from a program which included community singing and folk dancing, selling war bonds and raising victory gardens.

The English might be expected to be in a better position to understand civil defense. They at least came to grips with the realities of incendiary and high explosive bombs. However, they were hit lightly compared with what the Royal Air Forces (including Canadian Air Forces) dumped on over 54 German cities and what later the U. S. Army Air Forces dumped on 65 Japanese cities. Even the experience of Germans and Japanese was made obsolete when atomic bombs were dropped on Hiroshima and Nagasaki.

Civil defense could be defined in a general way as measures for mitigating the effects of airborne attacks on cities with high explosives and incendiaries. To these weapons were added a few cases of buzz-bombs, rockets and the two atomic bomb attacks before the end of World War II. Poison gas was not a good weapon for airborne attack, a fact which explains, better than fear of retaliation, why it was not used.

A future war will require defense measures against many new weapons. These will include guided missiles and possibly bacteria and others not yet described.

These are the difficulties encountered when one attempts to draw a line around the subject and say, "This is Civil Defense." Originally, the term "passive" defense was used. But, the defense might be active, as it would certainly include measures by which civil populations deal with paratroop invasion. In general, civil defense measures are those for which the military services do not provide. As an example, the military handles aircraft warning service, so that is one item outside of civil defense although related to it. Yet civil defense *functions* are performed by the military for their own fixed installations: posts, camps, depots and airfields.

Status of Civil Defense Planning

None of this is of importance to persons who brush off the possibility of future war. Most people do not know whether civil defense should be considered now or not. The U. S. Office of Civilian Defense was dropped with hardly a protest at the close of the war. The subject had only perfunctory attention until a new Office of Civil Defense Planning was set up in April, 1948, to report to the Secretary of National Defense. Under Russell J. Hopley, an Omaha telephone executive, a staff was assembled which prepared a report "Civil Defense for National Security" published in November, 1948. One of 21 divisions of the report was "Fire Ser-

vices in Civil Defense." In the preparation of this division, Chief Frank C. McAuliffe served as Fire Adviser. Chief McAuliffe was president, at the time, of the International Association of Fire Chiefs. In connection with the preparation of this report, a panel of eight large city fire chiefs and thirteen other fire experts was brought in for three days' consultation. This was informal, the consultants not being held responsible for the final report, nor was Chief McAuliffe or the Office of Civil Defense Planning bound by the suggestions given. Similar panels assisted with other features of the report. Chief McAuliffe's section dealt primarily with the fire department phases of civil defense, but fire protection and prevention factors were treated under several other divisions, particularly those dealing with plant protection, research (city planning), and engineering (water supply). Chief McAuliffe has subsequently been succeeded at the Office of Civil Defense Planning by Carl F. Dreesen as full-time Fire Fighting Engineer.

The Hopley report is a plan only and it is in circulation and available for study. Meanwhile the Office of Civil Defense Planning is being continued. One interim activity has been assisting in exercises in which state officials and the officers of army areas within the United States have tested out some operating concepts. This has been particularly useful in helping both military and civilian officials orient themselves to their respective roles in civil defense.

Eventually the Congress must give effect to formal civil defense action by appropriate legislation. Such legislation has not yet been taken up. It is conceivable that the latest development is a forerunner to a decision by the President as to what sort of legislation he will ask of the Congress. In March, he asked the National Security Resources Board (its function is to advise the President) to take responsibility for further action on civil defense plans.

Manpower Requirements

One reason for organized civil defense is to conserve manpower needed for prosecution of war. The mistake was made in the last war of organizing the entire country, tying up needlessly the energies and time of millions of people. It will be appropriate this time to limit full organization to strategic areas. Even in these, a minimum of organization should be undertaken.

The greatest manpower pinch will come with regard to certain types of technical experience, the supply of which is now limited. One example is fire department officers with experience in handling huge forces of apparatus and men. Another is sanitary engineers with public health experience. The mistake should not be repeated of throwing into a civil defense organization a lot of amateurs whose inexperience only adds to the difficulty of the technical problems which must be handled.

There is no sign yet that anything is being done to forestall troubles which the fire departments have experienced in two wars. Fire chiefs would like some assurance that their men will not be recruited for the armed services, haphazard, leaving their departments undermanned. The operation of veteran's-preference legislation forces firemen into the armed services. An officer or fireman who stays on the job is, ever after, placed at a disadvantage in seniority and promotion in which returning veterans have preference. Firemen and fire chiefs are likely to criticize the Hopley Report most vigorously for being silent on these points.

Plant protection will use up a lot of manpower. In view of two wars with a minimum of sabotage, it appears that "security" is overstressed. Time spent on "security" checks does not turn out production, and guards are not a substitute for basic fire protection such as automatic sprinklers. It will be better in many cases to take chances with individual plants instead of trying to furnish large forces of armed guards for them.

Inspection of plants for fire prevention could be handled by a civil defense agency for the properties which are a government responsibility. The pattern could be similar to that of the States' War Inspection Service operated by OCD in World War II. This would use inspectors in their present jobs rather than transferring them to the armed forces to do similar work. Such transfer is inefficient, as it means an inspector is working in new surroundings, perhaps away from home. His change of base may require extra housing (an office and a home). Military red tape alone would be likely to waste two or three months of the effective time of each inspector so transferred. To conserve manpower, inspection work should be done by contracts with existing agencies. This will be possible in most cases.

Regimentation

Walter Winchell sees in the Hopley Report an intent to put people under police regimentation. In this, he is unfair to the Hopley Report. In the general idea that civil defense could mean regimentation, he is right. Civil defense could be the excuse for invoking complete regimentation. Some regimentation is necessary. One example is universal registration and fingerprinting. This would be helpful for identification of bodies (at the Texas City disaster, this was a big problem).

It is necessary to have an organization for evacuation of people from a target area or an area which has been hit. This requires persons in authority who know where persons are and how to move them. There must be provision for emergency feeding, clothing and housing. There must be machinery for first-aid and rescue. Most of these functions would be provided by a civil defense warden service. It would be organized block by block, precinct by precinct. Such an organization is ready-made for domination by a political boss. At the very least, it would set up a horrible bureaucracy with people required to queue up for all the necessities of life and for official permission for even the smallest movement from place to place. This is a very real danger, suggesting that civil defense organization can go too far if made compulsory. In fact, civil defense would defeat its purpose by such measures. People, interminably queued up, have no time and energies for the activities which win wars.

Role of the Military

The military always has assisted civil authorities in floods, windstorms and other disasters. Under civil defense plans they would assist in a number of specific ways. They may operate some units of mobile reserves provided for civil defense. They will provide the important research through the Research and Development Board of the military establishment. Contrary to a widely held idea, it is traditional with the U. S. military to work with domestic civil authorities and other friendly civil authorities, rather than to "take over." They will assist, as in policing a devastated area, but usually by request of civil authorities and by agreement as to

the functions performed. It is nowhere apparent that the military have any desire to "take over" civil defense functions. Rather, the military expect to have their hands full and would surely stipulate that assistance would only be given in civil defense to the extent of the forces available.

Nevertheless, the military have not yet done the one thing in civil defense which is their responsibility and theirs clearly; that is, to define the part to be played in the national defense by civil defense.

It appears that Mr. Hopley and his staff may not have had full information on possible weapons. The plain fact of the matter is that there are very few military people in a position to furnish this information. The military is handicapped by the fact that the knowledge of individual military men is limited principally to high explosives. The understanding of the newer weapons of World War II, incendiaries and the atomic bombs, has not yet reached very far among military men. It would be difficult, for example, to name a single highly placed military man who thoroughly understands how incendiary weapons work. On other new weapons information is practically all in the hands of a few scientific specialists.

The military felt that they had to develop a civil defense plan and then hand to the civil authorities a complete package such as that outlined in the Hopley Report. Having done this much, they now realize that they must solicit the interest of civil authorities, i.e., federal, state and local. The same pattern of action occurred in England.

The civil authorities assumed that they had to wait for a package from the military which tells just how civil defense plans should be arranged. They now discover that some of the things which have to be done can be done better by the civil authorities themselves.

This unnecessary confusion could have been avoided by a little straight thinking. Future difficulties and misunderstandings will be avoided if it is realized that it is the military responsibility to define the problem and not to go very much further except to assist to the extent of available forces. It must be realized that the civil agencies not only must handle the operation of civil defense measures but should be expected to do most of the planning for civil defense as well. Plans made by the military for civil agencies are likely to be unrealistic.

Top Organization

There are several possibilities as to how the top organization of civil defense will be set up. One argument for putting the recommended Office of Civil Defense in the National Military Establishment is that it would have convenient access to the work of the Research and Development Board. This makes good sense. However, civil defense is so important politically that there should be a Secretary of Civil Defense as well as secretaries of the Army, Air Force and Navy.

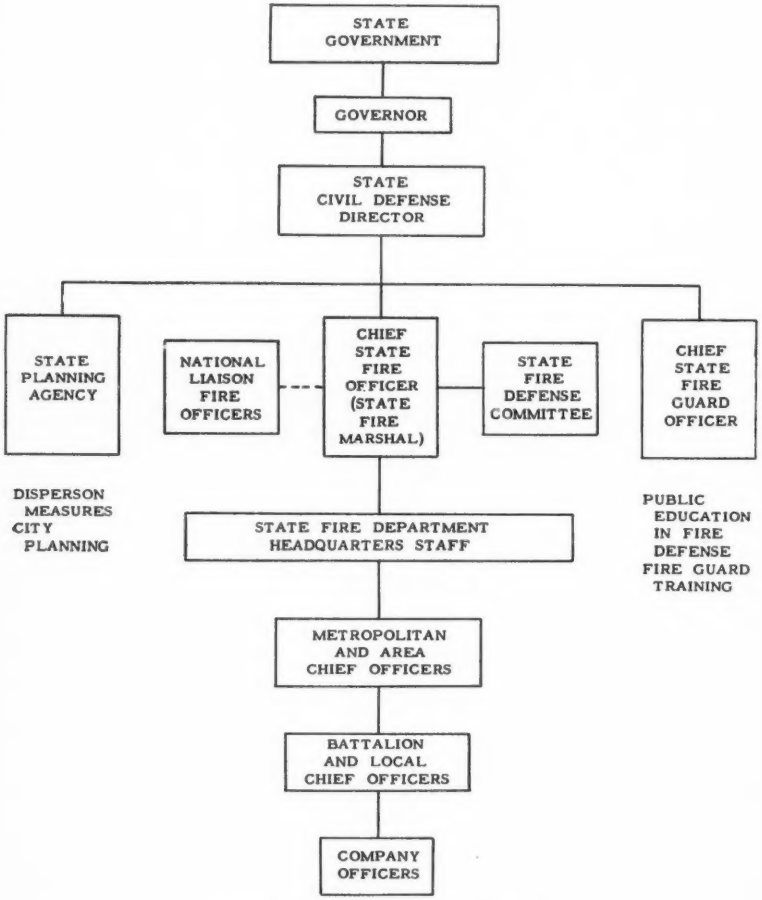
Other proposals will undoubtedly include the making of the Office of Civil Defense a part of one of the civilian cabinet departments. It could logically be handled by Interior or by the proposed new cabinet post of Welfare. The old OCD was a part of the Executive Office of the President. As noted, the subject has most lately been referred to the National Security Resources Board, a presidential agency.

Whatever decision is made regarding top organization, it is clear that civil defense must be handled at least at the na-

tional cabinet level. Whether civil defense starts as a full cabinet post or not, it will eventually become one as the full political implications of the operations of civil defense develop.

Regional Organization

The Hopley Report proposes a regional organization similar to that which was set up by the OCD, where each of the regional offices is a small branch of the national office. Such regional offices under OCD did not make for efficiency of liaison between Washington and the various states. The kind of regional office required in modern civil defense is something quite different from the regional


STATE GOVERNMENT
GOVERNOR
STATE CIVIL DEFENSE DIRECTOR
STATE PLANNING AGENCY
NATIONAL LIAISON FIRE OFFICERS
CHIEF STATE FIRE OFFICER (STATE FIRE MARSHAL)
STATE FIRE DEFENSE COMMITTEE
CHIEF STATE FIRE GUARD OFFICER
DISPERSON MEASURES CITY PLANNING
STATE FIRE DEPARTMENT HEADQUARTERS STAFF
PUBLIC EDUCATION IN FIRE DEFENSE FIRE GUARD TRAINING
METROPOLITAN AND AREA CHIEF OFFICERS
BATTALION AND LOCAL CHIEF OFFICERS
COMPANY OFFICERS

STATE FIRE DEPARTMENT ORGANIZATION

In state organizations for co-ordination of fire department operations in major disasters or for civil defense, there would have to be a directing state fire department organization. It would require component parts in the relationships shown in this chart.

offices contemplated by the Hopley Report. Instead of regional offices which act as an intermediary between the national and state levels of government, the regional offices should be provided primarily as alternate centers from which all of the national operations of civil defense may be conducted.

The further point should be recognized that all civil defense offices should be outside of congested cities or target areas. The national headquarters for civil defense should not be in Washington.

State Organization

The Hopley Report makes a courageous and forthright decision that civil defense should be handled primarily by the states. This is a very sensible decision in the American government where states are convenient subdivisions which may, in an emergency, operate individually even if cut off from the rest of the country.

Civil defense will require few new state offices. The problem at the state level is primarily one of co-ordination.

There will be some integration of services at the state level. There will have to be a center which can serve as a source of information for fire department operation. There will be a trend toward integration of fire departments. It will be necessary to consolidate fire departments at least in metropolitan districts.

There will have to be a Chief Fire Officer for the state and a Fire Staff. The staff will handle such matters as public relations, fire prevention, fire investigation, personnel, training, emergency apparatus, emergency feeding, housing and clothing of firemen and similar matters. It will be noted that a number of these fire staff functions are already being handled in some states at the state level, notably fire prevention, fire investigation, training and certain personnel matters as are covered by civil service laws.

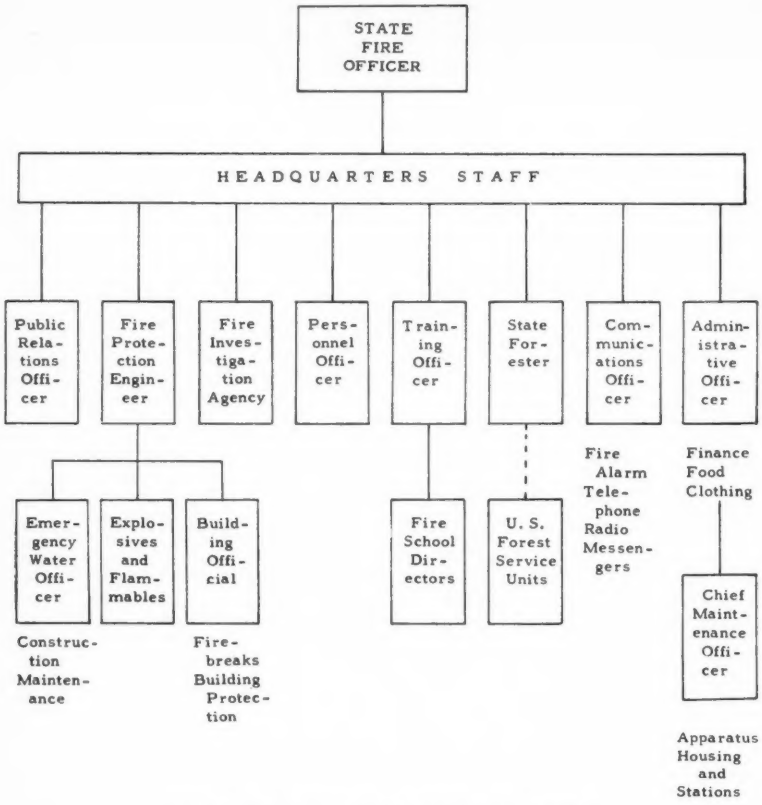
The state fire staff will be the custodian of any nationally issued apparatus and equipment and will approve reimbursement of local authorities for fire expenses.

Fire Departments

The question has already been raised as to how much will be required in the way of auxiliary fire apparatus, auxiliary firemen and additional fire department facilities generally. The same problem came up in 1939. At that time the Army invited a committee of fire experts to make suggestions as to how much additional auxiliary fire apparatus should be bought for fire defense of American cities. The sort of attack contemplated was the dropping of incendiaries and high-explosive bombs, as England was experiencing such attacks about that time. England had increased her fire forces about twenty times. The experts' judgment at that time was that in principal U. S. cities each existing fire department pumper company should be matched by an auxiliary company. OCD Director La Guardia, a fire fan, did not think this enough apparatus and ordered additional provisions be made for extra auxiliary apparatus and fire companies.

Wartime experience with fire department operations showed that it was not so much the total amount of fire apparatus provided, but whether or not the apparatus was manned and at the location where bombs were falling. In heavy attacks it made very little difference whether there were any fire department companies or not. Large fires were stopped by structural barriers and open spaces rather than by fire fighting operations.

There are, nevertheless, some fire fighting operations of value around the fringe



STATE FIRE DEPARTMENT HEADQUARTERS STAFF

A new feature of a state organization for civil defense or for co-ordination of fire department operations in major disasters would be a state fire department headquarters staff. Such a staff is required for co-ordination purposes and would be essential if all the fire departments of the state are consolidated into a single department. Only large city fire departments require such a staff in normal times. Note all of the regular functions of a large fire department and several new ones in this chart.

of an area hit by bombs. In modern warfare, it will do little good to increase the number of fire companies in a city. If the city is a target, the companies in the city will be lost; fire fighting companies available will be those which may be mobilized from suburban and rural areas.

It is doubtful, therefore, that provision of very much additional auxiliary apparatus or additional fire companies should be attempted as a wartime measure. In every state there is a large total number of fire companies and the problem is more likely to be one of having a state organization of fire departments such that fire companies can be mobilized from all over the state to work at a strategic center which may be hit. Such movement could be accomplished with proper organization without stripping any region of protection.

Fire Guards

In World War II, the largest civil defense service in England was the Fire Guard. It was the only civil defense service which was compulsory. The Hopley Report does not adequately deal with the question of fire guards, merely tacking fire watching on as a function related to the protection services in industrial plants.

It is probable that compulsory organization of fire guards will not be necessary, but it would be prudent to have a fire guard organization which can be expanded.

The best way to handle this particular matter would be to require widespread training, particularly in industrial and mercantile properties, for employees in how to handle first-aid fire fighting appliances. Such training is valuable even in peacetime; in wartime, it is likely to make it possible for many properties hit to be saved if the fire is caught in an early stage.

Properties in the center of a strike by an atomic bomb are likely to be wiped out, but with all fire weapons, including the atomic bomb, there is a fringe of the area hit in which first-aid fire fighting can be very useful.

Public Water Supplies

For fire fighting, it is ridiculous to contemplate piping in large quantities of water under war conditions. The only water which will be used to fight fires in an air attack will be that which is stored at, or near, the building on fire.

Peacetime trends in providing water supplies for fire fighting have been in the direction of additional local storage of water for fire fighting. The direction of work on this problem should be to encourage this trend.

Further, a study should be made to see if we cannot work out a more satisfactory method of providing public water for fire protection, even if this means separate fire service water supplies.

As a minimum, there should be a large tank of water available for pumper suction within a reasonable distance of every important block and every important building in a city. This requirement introduces new problems, some of them unexpected (in England, emergency water tanks presented all sorts of problems. They filled up with rubbish, and children fell into them).

City Planning

The National Security Resources Board, which now is also charged to consider civil defense, is likely to be an important national agency in connection with the physical defense of the country. This agency has already issued a helpful document entitled "National Security Factors in Industrial Location," which argues for decentralization. It reiterates the point made in the NFPA book "Fire and the Air War" that space is the only practical defense we have against modern bombs.

Another important national agency in this picture is the Research and Development Board of the National Military Establishment. It will do research to help establish policies to be followed with respect to decentralization, the area, bulk and spacing of buildings in cities, water supplies for fighting and related matters.

State statutes must invest local planning agencies with authority to put in effect plans approved by a state planning agency for measures outlined as essential for national defense or security. All measures for getting an increased proportion of open space to space occupied by buildings become of great importance in the national defense.

Acme.

Nine students were killed when fire spread with explosive speed through this 122-year-old dormitory. Inadequate exits, lack of automatic protection, nonfire-stopped floor, wall and attic spaces were among the factors responsible.

Kenyon College Dormitory Fire

In the early morning of February 27, fire was discovered in Kenyon Hall, oldest building on the campus of Kenyon College, Gambier, Ohio. Nine men students lost their lives and 25 required hospital treatment. Of those killed, two were fatally injured while attempting to escape from the burning building, one died in the hospital from burns and six were either suffocated or burned to death in the building. It is felt that the conditions responsible for this disaster are by no means peculiar to the campus at Gambier.

"Old Kenyon" had great historical significance to all Kenyon graduates. Although built 122 years ago as one of the original college buildings, its 60 rooms were still in use as dormitories for 120 students. A central section 105 ft. x 44 ft., and two wings each 40 ft. x 50 ft., comprised the 3-story structure. Exterior walls of stone tapered from 4 feet thick at the base to 2 feet at the top. Unpierced walls separated the wings from the central section but did not extend above the third floor ceiling. A main chimney located in the central section and extending from the basement through the roof was the original heating unit for the building. Several of the fireplaces in the various rooms that connected to this chimney had been sealed off when the building was remodeled in 1907, but many others were still usable, including those in the lounge on the first floor. Flues from these fireplaces which were in use on the night of February 26-27 entered the main chimney at the second floor level.

On the morning of the fire everything seemed to be in order when the night watchman, making his usual rounds,

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Based upon reports submitted by the State Fire Marshal, Ohio, and the Mount Vernon Fire Department.

punched the clock on the third floor of "Old Kenyon" at 3:35 A.M. Students who were still up and around after attending a late party in the first floor lounge also failed to notice any evidence of fire. At 4:00 A.M. a student returning from a party in another building saw a reflection in the first floor windows of the old parlor in the central section and ran to the power plant to notify the engineer. Students in the second floor room directly over the old parlor stated that the hot floor and smoke coming from the baseboards was their first indication of fire.

Flames were coming from second floor windows when the college fire truck driven by the engineer arrived. Students attracted by the excitement immediately attempted to warn all occupants and assisted with hose, but were soon forced from the building when a sheet of flame suddenly flashed through the hallways and open stairs, followed immediately by dense clouds of smoke. Many of the second floor students, upon opening the doors of their rooms, were met by a flash of flame and severely burned; others apparently died instantly from suffocation. Many jumped from upper floor windows when they were unable to reach or descend the ladder type fire escapes on the rear of the building. Several of those who jumped stated that the fire escapes were so hot that it was impossible to descend them.

The college fire department, consisting of one pumper, was joined by a pumper from Mount Vernon six miles away, but their efforts were wholly ineffective because of inadequate water. A single 4-inch main was the only supply available. Within the space of an hour the whole central section was a mass of flames and fire was spreading through the undivided attic to the two wings. Other construction features contributing to the rapid spread included

Fire Marshal, Ohio.

A defect in this chimney is the reported cause of the Kenyon College dormitory fire.

the 18-inch nonfire-stopped space beneath floors, and the soft pine floors which from years of oiling were undoubtedly soaked through. Two other factors are cited as possibly contributing to the heavy loss of life: (1) the absence of fire drills at the college and (2) a peculiar type of horseplay practiced by the students. On past occasions lighted wastebaskets had been placed in dormitory rooms followed by a shout of "fire." It is felt that many students upon hearing the shouts of "fire" on this particular night may have thought that it was horseplay and therefore did not immediately respond.

It is the general consensus of the investigating agencies that the fire was caused by deterioration of the old chimney, allowing fire to enter floor and wall spaces, where it smoldered until a hole was eventually burned through the first floor ceiling. It is believed that the inrush of air through this hole caused flames to flash with explosive speed through the nonfire-stopped partitions.

A Novel Foam System

By C. L. Jones*
(Member NFPA)

The recently installed foam fire protection system for solvent process buildings in the Brunswick Georgia Naval Stores Plant of the Hercules Powder Company includes many novel features in its design, and is probably the largest air foam system ever installed for the protection of buildings of a manufacturing process.

Processes Protected

The raw material used in this plant is old pine stumps, which were once considered as of no value for any purpose. The stump wood is milled into a fine shredded form, and by an extraction process various pine products are produced, such as rosin, resins, pine oil, turpentine, etc. These products are further refined, and are also used as raw materials to produce other chemicals.

The extraction process is carried out in pressure type extractors in a building known as the Extractor House. The solvent is benzene, C_6H_6. The operating pressure of the vessels and other parts of the extraction system is about 100 lbs per sq. in. at a temperature of about 285°F. After the various pine products have been extracted from the milled wood, the hot solution is processed in another building known as the Refinery, where the benzene is evaporated, after which the benzene is returned to storage tanks for reuse.

The various crude pine products after being separated from the extraction solvent in the Refinery are further processed in other buildings, one of which is the Pexite Plant, where the various commercial grades of rosin are produced. The solvents used in the Pexite building are gasoline and furfural. The quantity of solvents in process in each of the three buildings (Extractor House, Refinery and Pexite Plant) is large, the greatest amount being in the Extractor House.

The plot plan, Fig. 1, shows the size and relationship of the three buildings to each other, and to some of the other units on the plant. A sizable number of persons are employed in and around these building and in nearby areas; also, the investment in these three buildings and nearby units is large.

General Fire Protection

Hercules Powder Company's operation of this plant dates from 1920. Over the years, much thought and effort have gone into the design and operation of the facilities to minimize fire and accident risks for the protection of employees, as well as to safeguard the plant investment, and to assure a dependable supply of materials to consuming firms and industries.

The fire protection in place prior to the installation of the fixed foam protection described in this article consisted of deluge sprinkler systems in the Extractor House, Refinery and Pexite Plant, sprinkler systems of various types in all other buildings of importance on the plant, yard hydrants liberally placed, each being supplied with an adequate amount of 2½-in. C.R.L. hose, several portable foam generators with a liberal supply of foam pow-

*Safety Engineer, Hercules Powder Company, Wilmington, Delaware.

der, first-aid extinguishers of various sizes, such as 40 gallon foam, carbon dioxide, carbon tetrachloride, and dry powder chemical extinguishers of various sizes. The plant force had been trained in the use of all such facilities.

The water supply for the sprinkler systems is from a 100,000-gallon elevated water tank, providing an average static pressure of about 75 lbs. per sq. in. at ground level. Fire pumps of several thousand gallons capacity per minute at about 100 lbs. per sq. in. supply the cast iron underground fire protection system, which feeds all of the various sprinkler systems throughout the plant, as well as the yard hydrants.

Many features of fire and life safety have been provided. Each new employee is individually instructed in the fire prevention features of his own job. The plant fire brigade is regularly drilled in handling the special types of fire situations which might arise at this plant. Adequate emergency exit facilities have been provided for high hazard areas; for example, the upper floors of the Extractor House have slide escapes leading directly away from the building. Buildings where flammable solvents are handled are largely of the open type, with columns, floors and roofs but no solid walls, thus providing good ventilation and also venting to minimize the seriousness of any explosion which might occur. A railroad branch line through the plant was purchased by the company, and Diesel locomotives were substituted for steam locomotives to avoid the hazard of locomotive sparks. All welding and other repair operations which might cause fires are carefully safeguarded through a system by which such operations are not permitted in any location not approved by the plant fire protection man. All employees and visitors are required to leave their smoking materials and matches at the gate when they enter the plant.

Plans for the Foam System

The existing fire protection would have seemed adequate by ordinary standards, but Hercules Powder Company management believed that the protection might not be effective in the event of a large spill of benzene or other solvent followed by fire, because water in any form (including "fog"), while useful in combating solvent fires, is not a completely satisfactory extinguishing medium for such fires.

A decision was made, therefore, to devise a system of protection which would be quickly effective on a fire involving benzene or other solvents which might occur in any one of the three main buildings; and that protection to be adequate to combat a fire involving all three floors of the Extractor House, having a total floor area in excess of 35,000 square feet.

A large amount of research work was carried out. Different fire fighting mediums were considered, and various size tests were made on fires involving burning areas up to about 1,000 sq. ft. per fire and 700 to 800 gal. of benzene. The fire extinguishing materials considered and tested were: high pressure water fog up to 700 psi; dry powder chemical; "wet" water; carbon tetrachloride; inert gas (CO_2); and fire foams of various kinds.

After completion of the various tests which extended over a period of a year and a half, the observed results led to the conclusion that a protein base foam with an expansion of 9 to 10 was the best medium for controlling benzene fires, and that such foam would also be effective on other solvent fires which might occur. For example, in tests involving a surface

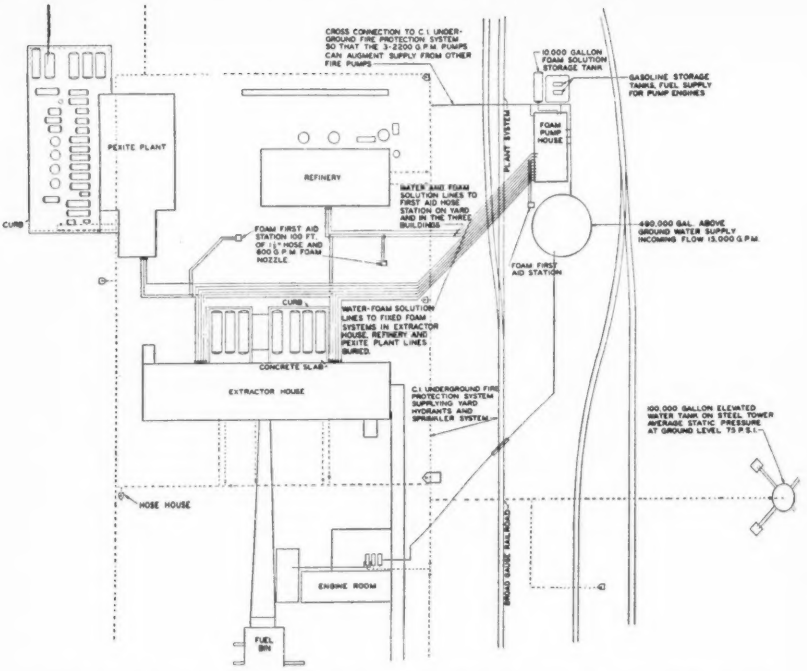

CROSS CONNECTION TO C.I. UNDER-GROUND FIRE PROTECTION SYSTEM SO THAT THE 3-2200 G.P.M. PUMPS CAN AUGMENT SUPPLY FROM OTHER FIRE PUMPS
10,000 GALLON FOAM SOLUTION STORAGE TANK
GASOLINE STORAGE TANKS, FUEL SUPPLY FOR PUMP ENGINES
FOAM PUMP HOUSE
PLANT SYSTEM
PERITE PLANT
REFINERY
WATER AND FOAM SOLUTION LINES TO FIRST AID HOSE STATION ON YARD AND IN THE THREE BUILDINGS
CURB
FOAM FIRST AID STATION 100 FT. OF 1½" HOSE AND 600 G.P.M. FOAM NOZZLE
490,000 GAL. ABOVE GROUND WATER SUPPLY INCOMING FLOW 13,000 G.P.M.
FOAM FIRST AID STATION
CURB
WATER-FOAM SOLUTION LINES TO FIXED FOAM SYSTEMS IN EXTRACTOR HOUSE REFINERY AND PERITE PLANT LINES BURIED.
CONCRETE SLAB
EXTRACTOR HOUSE
C.I. UNDERGROUND FIRE PROTECTION SYSTEM SUPPLYING YARD HYDRANTS AND SPRINKLER SYSTEM
100,000 GALLON ELEVATED WATER TANK ON STEEL TOWER AVERAGE STATIC PRESSURE AT GROUND LEVEL 75 P.S.I.
HOSE HOUSE
BROAD GAUGE RAILROAD
ENGINE ROOM
FUEL BIN

Fig. 1. Plot plan showing foam line for protection of Extractor House, Refinery and Perite Plant.

area of 800 sq. ft. covered by 700 gal. of benzene, the fire was extinguished in less than three minutes, and the foam blanket was so effective that it was not permeated by any appreciable quantity of benzene vapors, as indicated by failure to ignite vapors when a large torch was passed over the top of the foam blanket.

Foam on Hot Benzene

Tests were also carried out to determine the effectiveness of a foam blanket on a fire involving hot benzene. Even with the benzene at near its boiling temperature, the foam blanket was effective in extinguishing the fire. Even with the steam heat remaining on the steam coil immersed in the benzene, there was no reignition of the vapors above the foam blanket when a large torch was passed over the top of the foam blanket.

A liquid foam solution instead of foam powder was selected because of ease of operating the foam producing equipment and the simplicity of design. When using the liquid foam solution, one man, by operating a few switches, can quickly start all of the equipment and arrange for the delivery of the foam solution to the desired point, where it is applied by fixed systems. By "quickly" is meant that foam can be discharging from all of the outlets comprising the fixed foam systems within about one minute from the start of a fire.

The design of protection finally adopted included fixed water-foam solution distribution systems somewhat comparable to

sprinkler installations, in each of the three buildings. In the 3-story Extractor House, there are six systems, each being arranged to protect half of one floor. A nearby building which houses pumps handling benzene and a number of large benzene tanks near the Extractor House, are similarly protected.

In each of the two other buildings a single system is installed. Here also, the nearby area on which the outside "work" or process tanks are located is foam protected.

Foam Applicators

It was reasoned that if fires should occur, those of greatest magnitude and severity would probably be at the floor or ground levels; therefore, the protection should be applied at these points rather than by spraying the foam through the air from nozzles or other outlets located high above the protected area.

The foam applicators as installed are placed so the discharge deflector plates are about 9 in. to 12 in. from the floor, or other surface protected. The piping distribution system which supplies the various foam makers is above head height with an air aspirator near the top of each foam maker. Figure 2 shows a typical foam maker installation. The nozzles are so placed that in case of need all areas of all floors can be quickly covered with foam. The floor or ground of each protected area can be covered with a foam blanket at least 6 in. deep within three minutes or less. In the case of the Extractor House, this calls for a delivery of about 130,000 gallons of foam in that time. This is the largest load for any of the buildings.

In order to build up the required depth of foam blanket on the various floors, concrete curbs at least 6 inches high have been

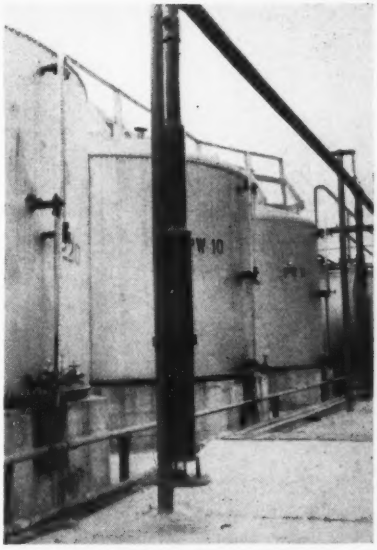


Fig. 2. Typical foam maker installation protecting area around solvent tanks.

installed around the building perimeter on all floors. Similar curbs have been installed around all floor openings, so that each floor level or other surface protected is in effect a pan at least 6 inches deep. Thus, if a liquid spill should occur, it is retained within that pan, and when foam is applied, it builds up on top of that liquid surface. These curbs have also been placed around the protected tankage areas near the buildings.

The rate of foam application, about 1.20 gallons per square foot per minute, is in excess of the minimum requirements set by the Underwriters' Laboratories for the protection of tanks.

Foam Supply Equipment

Three 2200 G.P.M. centrifugal water pumps, which deliver water at a pressure of 140—160 lbs. per sq. in., supply the water-foam solution. Each of these pumps is driven by a 200 H.P. electric motor. In

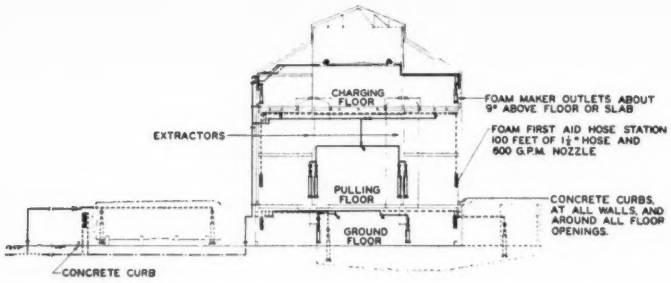

CHARGING FLOOR
FOAM MAKER OUTLETS ABOUT 9" ABOVE FLOOR OR SLAB
EXTRACTORS
FOAM FIRST AID HOSE STATION 100 FEET OF 1½" HOSE AND 600 G.P.M. NOZZLE
PULLING FLOOR
CONCRETE CURBS AT ALL WALLS AND AROUND ALL FLOOR OPENINGS.
GROUND FLOOR
CONCRETE CURB

Fig. 3. Cross section of the Extractor House showing location of foam outlets. Sides of building are open.

addition, two of these pumps have auxiliary gasoline engine drives. The water from all three pumps is delivered to a manifold, from which individual underground steel pipe lines supply the fixed foam systems in the various buildings, each such line being manually valved off at the manifold. (See Figs. 4 and 5.)

To inject foam solution into the suction of the three 2200-G.P.M. water pumps, two 400-G.P.M., 65 pounds per square inch, centrifugal pumps are installed. The capacity of one of these two pumps is sufficient to supply the maximum quantity of foam solution required, and both are arranged to discharge foam solution into the suction line supplying water to the three 2200-G.P.M. pumps. One of these solution pumps is driven by an electric motor, the other by a gasoline engine.

Proportioning of Foam Solution

The desired water-foam solution is about 6%, although it has been found by test that the foam made from a solution which varies somewhat from this concentration is practical and effective.

The proportioning of the foam solution is controlled by means of orifice plates which pass the required quantity of foam solution into the water suction line. For example, suppose one of the fixed systems calls for 600 gallons of a water-foam solution. The foam-solution pump will deliver, through an orifice in the solution pipe line, 36 gallons per minute of foam solution into the pump suction line, while 564 gallons of water per minute are discharged by the 2200-G.P.M. pump.

The 2200-G.P.M. water-solution pump will discharge the 600 gallons of water-foam solution to the system calling for that amount, as the requirements of the particular system will call for approximately that quantity of foam solution. The excess over the 600 G.P.M. demand is discharged back into the suction side of the water-solution pump by means of a relief valve.

The 600 gallons per minute of water-foam solution is delivered to the particular system needing foam. Near the top of each foam maker there is an air aspirator, which automatically mixes air with the solution, which is then delivered onto the burning surface.

To apply foam to any or all sections of the Extractor House, the operator manually starts one or all of the 2200-G.P.M. water pumps, and also one of the 400-G.P.M. foam solution pumps. The water-solution valve supplying a particular fixed foam system and the corresponding foam

solution valve are then opened (all of which are permanently labeled); then the foam will be automatically discharged from all applicator devices in that particular system. If every one of the six foam distribution systems in the Extractor House is put into operation, all that is necessary is that the other five water-solution valves and the corresponding five foam solution valves be opened.

A sufficient quantity of foam solution is provided to supply the maximum load for a considerable period of time. This foam solution is stored in a 10,000-gallon, above-ground, steel tank, normally closed to the atmosphere. Both of the foam solution pumps have a flooded suction, and solution is always up to the pump suction. This tank is insulated to protect the contents from extremes of temperature.

The record indicates that the stability of the selected foam solution is exceptionally good; that is, there are records of such

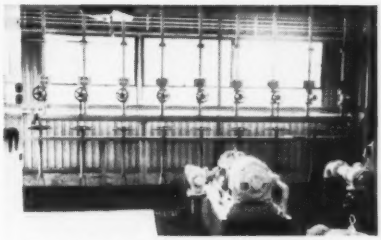


Fig. 5. Control valves for fixed foam systems.

foam solution remaining sweet for many years, even under adverse storage conditions including rather high atmospheric temperatures in various parts of the world.

Water Supply

The quantity of water immediately available for supplying the 2200-G.P.M. pumps is about 400,000 gallons. This water is stored in an above-ground steel tank located near the building housing the various pumps. The water flow (from wells) into this tank is 15,000-18,000 G.P.M. This tank is so placed that there

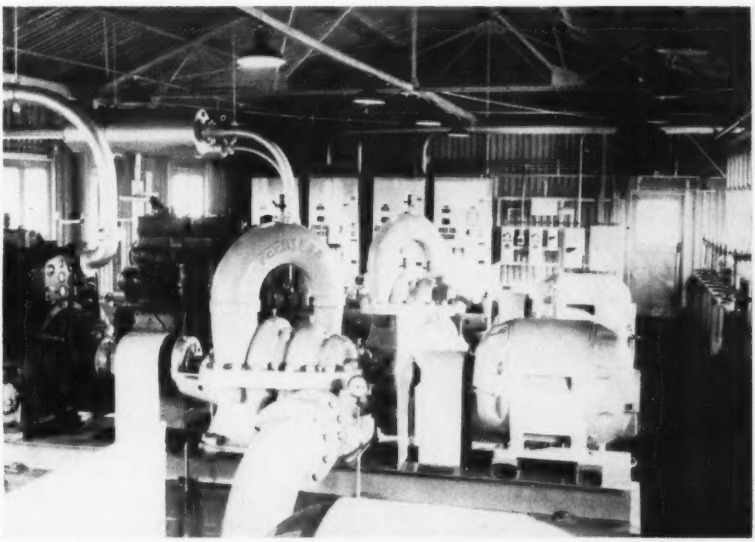
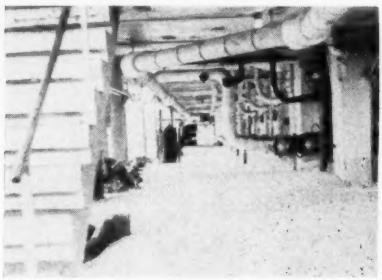


Fig. 4. Interior of the Foam Pump House. 2200 GPM pumps are driven by electric motors (right) with auxiliary gasoline engine drive (left). Control panel in background.

Conditions at start of Test.

Foam flow at 1 min. 30 sec.

Foam covering floor at 3 min.



Floor completely covered in 4 min. 30 sec.

Fig. 6. Test of foam application on lower floor of Extractor House. Foam discharge outlets at right. In 4 min. 30 sec., the floor was completely covered with full 6 in. depth at the outer edge (left).

is at all times a positive head of several feet on the suction of each of the 2200-G.P.M. water-solution pumps.

To augment the supply of water for the yard hydrants throughout the entire plant, and for all installed sprinkler systems, a cross-connection has been made from the discharge header of the three 2200-G.P.M. pumps to the underground fire system. Thus, in case of need, a large added volume can be pumped into the underground fire protection system, providing a total pumping capacity of about 10,000 G.P.M., available for fire fighting purposes.

As the cast iron underground system is designed for a pressure of 100 lbs. per sq. in., it has been necessary to limit the pressure of the water discharged into this system by the three 2200-G.P.M. pumps to that figure by automatic means.

First Aid Foam Protection

In addition to the fixed protection, first-aid foam hose streams have been provided in the various buildings for combating small fires if any such should occur. There are 12 first-aid stations in the Extractor House, 4 in the Refinery, 4 in the Pexite Plant, and 4 in the yard area between the Extractor House and the Refinery.

This first-aid part of the foam protection is arranged as follows: Water and foam solution, always under pressure, is up to the respective quick opening valves at each first-aid station, so all that is necessary is for an operator to open these valves, and both water and foam solution are

being admitted in proper proportions to the first-aid hose, each of these hoses being fitted with a foam making nozzle.

One hundred feet of 1½-in. hose, mounted on reels, has been installed at each first-aid station, and is permanently connected. The capacity of each such hose line is 600 gallons of foam per minute.

To maintain pressures on the first-aid system, a small water pump is arranged to operate automatically. If the water demand from the first-aid stations should exceed the capacity of this pump, one of the 2200-gallon pumps is also arranged to operate automatically, starting up after a predetermined drop in pressure.

A similar method applies pressure to the foam solution; except, in this case, the automatically operated small foam solution pump is sufficient to supply the maximum number of first-aid foam hose stations which might be put into use.

Sprinklers and Foam

All three foam protected buildings are also protected by sprinkler systems, and in case of fire, water could be discharging from many sprinklers. It was at first thought that this sprinkler water discharging on to the foam blanket would quickly damage it, and some consideration was given to the idea of shutting off the sprinkler systems. However, it was found that the foam blanket was not seriously damaged by water flow from sprinkler heads for a number of minutes; therefore, the decision was reached to leave the sprinkler system on in all three buildings. The water discharge from the sprinklers will serve to cool structural members and equipment, and in so doing will effectively aid in combating fire, and without seriously damaging the foam blanket.

Acknowledgment

Several persons assisted the writer in the preparation of the design of the fire protection facilities described. Of these, the following men are deemed worthy of special thanks for their efforts and contributions: L. W. Boerner, Chief Engineer of the National Foam Systems, Inc., West Chester, Pennsylvania; C. B. Miller, Vice-President of Automatic Sprinkler Corporation of America, Youngstown, Ohio; H. N. Rider, Manager of Technical Division of the same firm; and E. B. Rumble, Manager of Fire-Fog Department of that firm; J. A. McGarry, Project Engineer of the Engineering Department of the Hercules Powder Company, Wilmington, Delaware; and M. S. Byers, General Safety Supervisor, Hercules Powder Company, Brunswick, Georgia.

All of these men contributed a great deal to the creation of a new kind of fire protection for solvent processes, the completion of the installations, and the final testing of the systems.

Fire Alarm Central Stations

The fire alarm central station is the communications center of the fire department. Here all alarms are received and dispatched to the firemen, calls for additional firemen and equipment necessary and the multitude of routine communications by telegraph, telephone and radio that are incidental to the efficient management and operation of the fire department are cleared through this station.

The public safety requires that the central alarm station be in continuous operation, 24 hours daily, as even a temporary suspension of its functions may have disastrous consequences affecting the entire community. Fire is the principal menace to the continuity of service and unless the building is so located and constructed that both external and internal fire hazards are eliminated, an insignificant blaze in a vital spot may disrupt fire signaling for hours.

A survey of fire alarm central stations of the country reveals that the security of this vitally important element of the fire department has not received the attention it deserves. The officials of some cities, both large and small, have exhibited a proper degree of fire consciousness by housing the central alarm station in isolated fire-resistive buildings, but in the great majority of cities these stations still remain in buildings used for other than fire departmental purposes, lacking in fire-resistive qualities and exposed to the external hazards common to congested city areas. Internal hazards such as wooden structural members, highly combustible interior finish, rooms for repair work, storage of combustible materials, and similar conditions are frequently found.

Fires in Fire Alarm Central Stations

The danger involved in tolerating fire hazards in central alarm stations is real, not theoretical. During the current century, many cities have had their fire alarm systems disrupted by fire. The following listing of fires and disasters, although incomplete, serves to call attention to the seriousness of the hazard:

Major conflagrations have destroyed fire alarm central stations at Jacksonville, Fla.; Paterson, N. J.; Waterbury, Conn.; Baltimore, Md.; San Francisco, Calif.; Chelsea, Mass.; Chisholm, Minn.; Hot Springs, Ark.; Paris, Texas; Norfolk, Va.; Astoria, Ore.; and Salamanca, N. Y.

Other fire alarm systems have been put out of service by fires in combustible city hall or municipal buildings in which they were housed, as follows: Marlboro, Mass.; Berkeley, Calif.; Biddeford, Me.; Portland, Me.; McAlester, Okla.; Ludlow, Vt.; Shelbyville, Ind.; and Newark, N. J. This latter fire put out of service all of the seven hundred odd fire alarm boxes in the city. It broke out in the sub-basement of the Newark City Hall on March 10, 1924, melting lead sheathing on the cables, causing short and cross circuits, and causing $50,000 damage as well as the interruption to fire alarm service.

By working all night the fire alarm department succeeded in cutting in one hundred of the boxes by eight o'clock the next morning, but it was one o'clock in the afternoon before the service was completely restored.

All of the firemen on the off platoon were called in and put out on patrol duty to

watch for fires. Trolley cars were stopped and the passengers told that, if the fire department were needed during the night, telephones should be used. Fortunately there were no serious fires during the night, only a few still alarms being received at headquarters.

This building was of the semi-fire-resistive, slow-burning type. It afforded much better protection to the fire alarm office than is provided in the majority of cities throughout the country, yet the system was out of service for eighteen hours and would have been out for a longer time if it had not been for the skillful work of the fire department and fire alarm bureau. The *Newark News* in commenting editorially on this fire said:

> "The fire in the city hall Monday night, although its havoc was confined to the basement and sub-basement floors for the most part, served to bring home to the city authorities one special lesson of large magnitude: This was that the fire alarm telegraph signal system of the Fire Department is perilously housed on the top floor of the city building.
>
> "The fact that the wire connections of the fire alarm system, massed in the cables which form the direct and vital communications between the headquarters and the fire houses, was put entirely out of business by short and cross circuits and by the burning out of the cables proved the whole signal system to be at the mercy even of a not otherwise serious mishap.
>
> "The removal of the system to a building specially erected to house it and absolutely proof against fire or other mishap has been suggested. The fire alarm system is so vitally linked up with the safety of the city, with its property and with the very lives of its people, that the best protective measures to insure its uninterrupted functioning are imperatively necessary."

The following cases of serious interruption of fire alarm service or destruction of fire alarm equipment have occurred where this equipment was housed in fire department headquarters stations of combustible construction: Waltham, Mass.; Duluth, Minn.; San Jose, Calif.; McKeesport, Pa.; Alexandria, La.; Jamestown, N. Y.: Dracut, Mass.; Westerly, R. I.; and Westwood, Mass.

Other cases of destruction or disruption of fire alarm central station equipment include loss of fire alarm equipment when fire destroyed a police station at North Adams, Mass.; destruction of fire alarm equipment housed in a telephone exchange at Machias, Maine; inundation of a fire alarm central office on the banks of the Merrimack River at Haverhill, Mass. during a major flood; and destruction of the headquarters fire station housing the fire alarm equipment during an earthquake at Long Beach, Calif.

No attempt has been made to gather information regarding fires which seriously threatened but did not destroy the fire alarm office. A fire in Columbus, Ohio, occurring a few years ago, focused the attention of fire department officials, insurance engineers and a section of the press on this most important matter. The fire broke out in a building adjoining fire department headquarters. The building was completely destroyed and for a time threatened to destroy the fire alarm headquarters. The following editorial from the *Philadelphia Bulletin* is typical of the interest which this fire stimulated.

Running a Needless Risk

> "The story of a fire in Columbus, Ohio, which came within five feet of the central switchboard of the city's fire alarm service, and by leaping that little distance might have crippled that part of the city's protection, has its warning for Philadelphia.
>
> "The headquarters of Philadelphia's fire alarm service are on an upper floor of City Hall in a room which is surrounded by offices containing inflammable material. It is by no means inconceivable that a fire should start within the City Hall building, in such proximity to these headquarters that the apparatus or its connections might be put out of commission."

Consequences of Interruption

Interruption of central alarm station functions destroys, while it exists, the fire

alarm protection of the entire city and consequently the effectiveness of the fire department. Until means for receiving communications are re-established all fire alarm boxes and the commercial telephone service as well would be disconnected and of no avail. It would be a physical impossibility to immediately notify all citizens to report a fire at the nearest fire station instead of using the nearest fire alarm box. Loss of time would increase the fire loss and might lead to a conflagration.

The central alarm station is also the communications center of the fire department. Through it the Fire Chief maintains control of the department while engaged in fire fighting operations and any interruption of its functions would be a serious handicap, especially in the event of simultaneous fires.

Boston, not long ago, had a three-alarm, a two-alarm and a single alarm fire all within fifteen minutes. A few weeks previous three four-alarm fires had broken out in the same city within two hours. During the same week Washington and San Francisco had two four-alarm fires within a few hours. During a January cold spell in Chicago a few years ago there were three hundred and fourteen alarms in twenty-four hours, followed by two hundred in the next twenty-four hours.

In St. Louis a few years ago two large fires in the business district called out about forty engine companies and twelve hook and ladder companies. At times that night there were but seven engine companies left to protect an area of sixty-five square miles. These are some of the conditions that can lead to conflagrations and why the communications center of the fire department should be safeguarded.

Fire alarm signals are sent to the fire stations over two paths, the primary and secondary alarm circuits. These two paths are provided in order to provide a 100 per cent margin of safety in the transmission of fire signals to the firemen; another factor of safety is the provision of a telephone circuit from the central alarm station to each fire station — but, if the central station is destroyed, both signaling and telephone services are put out of commission.

The restoration of complete service after a central alarm station is destroyed by fire is a serious problem. The equipment is not carried in stock by any manufacturer and must be designed to meet the particular requirements of any given city if proper efficiency is to be secured. While equipment capable of rendering temporary service may be borrowed from the manufacturer or otherwise obtained in a few days or weeks, usually from six months to a year is required for the proper development and installation of a central alarm station for a large city — after the legal formalities incidental to obtaining an appropriation and securing public competitive bidding are complied with.

The Fire Alarm Central Station Building

The Standards of the National Fire Protection Association for the installation, maintenance and use of Municipal Fire Alarm Systems* require that buildings housing centers of communications shall be of fire-resistive construction with an absolute minimum of combustible contents and noncombustible window, door, interior trim, instrument cases and equipment. The fire alarm central station should be located in a park or other location where it will be unexposed for a minimum distance of 150 feet and windows and other openings shall be protected

*National Fire Code, Vol. IV; National Board of Fire Underwriters Pamphlet No. 73.

Typical Operating Room of Class A Fire Alarm System. Equipped with 14 box circuits, 4 primary and 4 secondary alarm circuits.

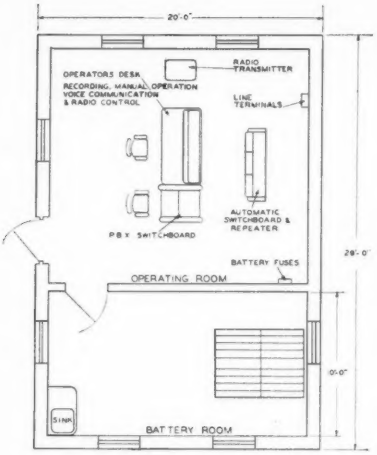
against exposure from any source. Internal hazards such as heater room, workshop, storage areas, and garage must be suitably cut off from operating rooms. Approved portable extinguishers must be well distributed to protect against internal hazards. Security against accidental or malicious tampering with fire alarm central station equipment must not be overlooked. It is well to have the property properly fenced and particularly in Class B systems which are not under constant supervision of an operator, the fire alarm equipment should be kept locked against unauthorized entry.

An entirely separate building so located as to be in the highest possible degree immune from fire, flood, and earthquakes is recommended. In the smaller communities with limited personnel it may be necessary for operating reasons to house the central alarm equipment in an annex to the fire station or other municipal building, but in every case the building should be free from danger of falling walls, external and interior fire hazards.

For the large and medium sized cities there should be no compromise with expediency at the expense of public safety, and an isolated building is recommended in every case. The building need not be large, even in the largest cities, and at a moderate cost can be made attractive in appearance and so as to harmonize with its surroundings and ornament any public park or a square.

Among the factors to be considered in selecting a location for the fire alarm central station are the following:

1. The location of the present cable center of the city. Other things being equal, the alarm office should be located as near the cable center as possible to save construction work and permit the underground wires to be brought into the building from two, three, and four directions instead of concentrating all the wires in one manhole.



Floor plan of a typical Class "B" Central Station. Initial capacity — 4 box circuits and 2 alarm circuits with space for expansion to 10 or more circuits.

2. The trend of future growth of the city. This factor should receive careful consideration before the location is finally determined. A study should be made of the possible future population growth with the aid of the experience of the telephone company and other public utilities which make such forecasts.

3. The relation of the Central Station to areas of possible conflagration. By utilizing the available surveys which have been made and the knowledge of the fire protection authorities it is possible to say definitely that there are certain sections of the city which should not be used because of the conflagration danger.

The hazard of the central fire alarm equipment which is not now in a satisfactorily located building of proper construction can be considerably reduced by the installation of automatic sprinklers and fire detection equipment throughout the building.

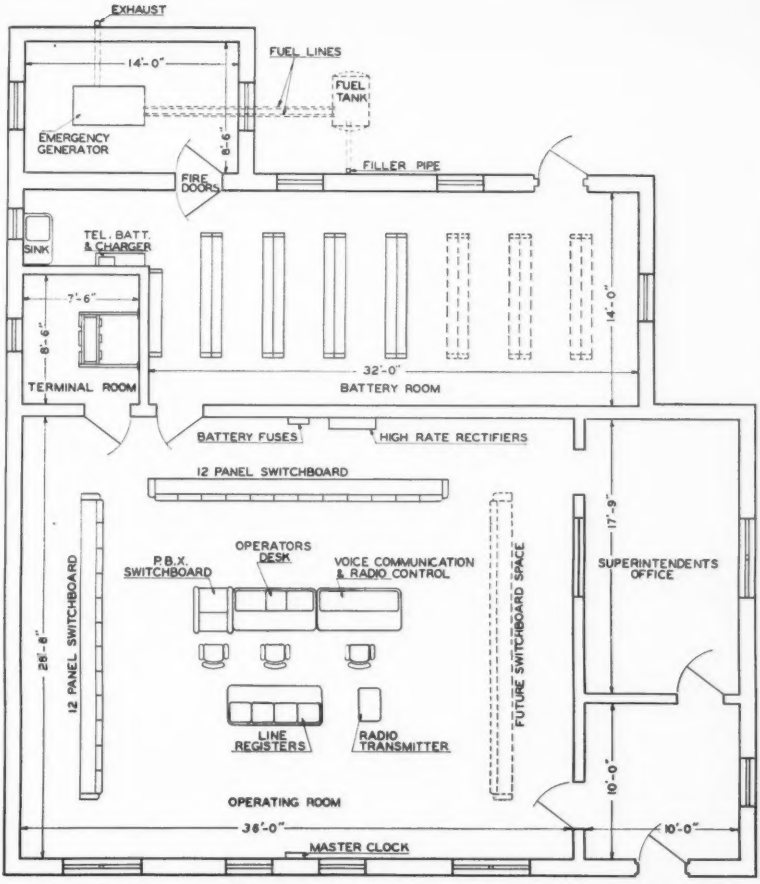
Design of the Central Alarm Stations

These buildings should be designed primarily for the purpose of housing the communications centers of fire departments and to permit the arrangement therein of the fire alarm, telephone, radio, voice communication and any other equipment employed in a manner intended to provide the most efficient operating arrangement and the most economical use of space. Ample space should be provided for future expansion of the system.

Plan A shows a typical arrangement for a large city having a manually operative central alarm station (Class A System) with an initial capacity for 30 box circuits, 4 primary and 4 secondary alarm circuits with provision for future expansion to as many as 60 circuits of all classes. The solid lines show the equipment comprising the initial installation — the dotted lines show the provision for future growth.

The Standards require that two independent, reliable, and constantly available sources of current supply be provided, but when two separate circuits from a public utility system, so serviced or connected that normal supply to one will not be affected by trouble which would put the other out of service are not available, one supply circuit from a public utility distribution system and a second supply circuit from a generator driven by an internal combustion engine, a water wheel, steam engine or turbine — if so located as not to introduce a hazard to the station — may be used.

The Plan A shows a proper arrangement for such an alternative source of power in the form of a gasoline engine-driven generator located in an extension to the central station building with a gasoline tank buried in the ground at some distance from the structure.



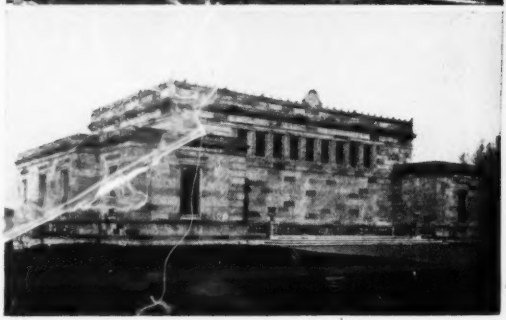
Floor plan of a typical Class "A" Central Station. Initial capacity — 30 box circuits, 4 primary and 4 secondary alarm circuits, with space for expansion to 60 or more circuits of all classes.

In addition to the operating and battery rooms, provision should be made for office space for the superintendent of the signal and other communications services, for any other fire departmental officials who will make their headquarters in the building, and maintenance of a stock of materials such as register tape, fuses, tools and other parts required in the operation and maintenance of the central alarm station.

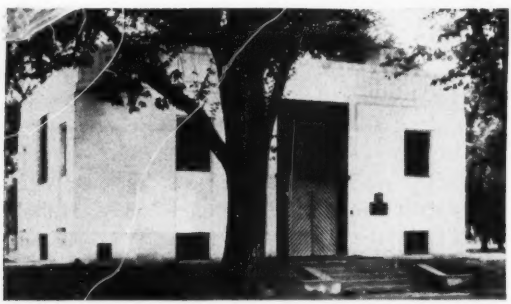
Having determined the capacity of the initial central station equipment, the provision that should be made for future expansion of the fire alarm system, for office, and the entrances for underground cables, the architect will study the site and design the exterior of the building in accordance with the surroundings.

This two-story air conditioned building was erected in Houston, Texas, in 1939. It is located in Sam Houston Park and houses the fire alarm and police signaling central stations.

Montreal fire alarm headquarters, erected in 1931, is located in a park, contains the headquarters offices of the Fire Department in addition to the fire alarm central station.

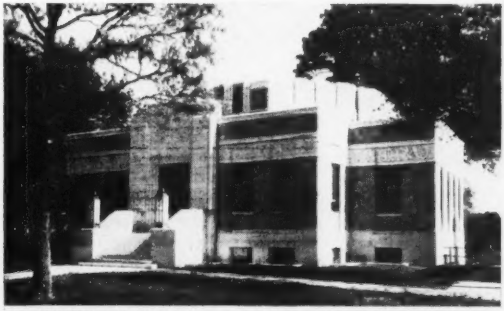


Located in Fenway Park, Boston, Mass., this building is used exclusively for fire alarm purposes.

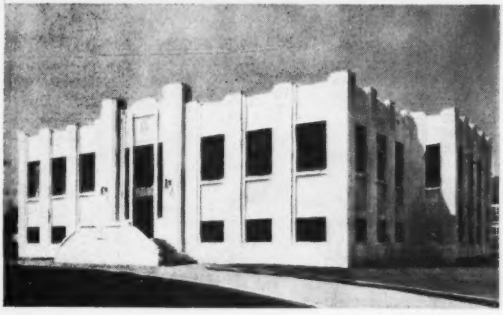


The building in Sacramento, Calif., erected in 1937, is used only to house the fire alarm central station.

Chelsea, Mass., lost its fire alarm office in the 1908 conflagration. This present fire-resistive structure is well detached from exposures.



The Tulsa, Oklahoma, fire alarm headquarters building is located in a public park.



Vancouver, British Columbia, houses its fire headquarters and central alarm station in an isolated building.

Newton, Mass. This building, located in a park, houses fire headquarters and the fire alarm central station.

An isolated, one-story and basement building is located in McMillan Park, Washington, D. C. The operating room, battery room, offices and kitchen are on the ground floor. Storeroom, emergency generator room, heater room and a garage are in the basement. The heater room and garage section are separated from the rest of the basement by self-closing labeled fire doors.

Poughkeepsie, New York. This fire alarm central office is located in a park.

East Providence, Rhode Island. This fire alarm central office is located adjacent to a fire department station. There is no direct communication between the two structures, it being necessary to go out of doors to enter the fire alarm building.

This Adams, Mass., building houses a typical, detached fire-resistive fire alarm office for a small community having a Class B alarm system.

U. S. Air Force Studies on Protective Clothing

Dr. K. Buettner of the Department of Biophysics of the USAF School of Aviation Medicine (Randolph Field, Texas), has been working since 1943 on the development of aluminum foil clothing for the protection of personnel who might be exposed to fires of conflagration proportions or to heat flashes from atomic bombs. Wright Field's Air Materiel Command, cooperating on the tests, has announced the results of the experimental work in news releases to the public press and in several feature stories which have appeared in popular newspapers and magazines. Not all these news releases have given a correct impression of the protective clothing and this article has been prepared to give the facts about the development, to emphasize the value and importance of the research and its product and to correct the erroneous impression that the aluminum foil suit alone, i.e., without further protection, can be used to walk through flame. The sole purpose of the suit is to afford bodily protection from radiant heat. If glass fabric, or a similar noncombustible material, is used for mounting the aluminum foil, the suit provides some additional protection against exposure to flame contact.

Air Materiel Command

This photo shows the aluminum foil suit as designed by Dr. Buettner and the Aero Medical Laboratory, Clothing Branch, U.S.A.F. Air Materiel Command. Further research is in progress to impregnate or process the material to increase flame contact resistance and to prevent tearing, scuffing or peeling of the foil.

Dr. Buettner has supplied the NFPA with a copy of his research paper which explains the development of his protective clothing, entitled "Protection of Man Against Conflagration Heat." The author explains that large scale fires (and the heat flash of the atomic bomb) impose severe radiant heat hazards upon man. In Hiroshima and Nagasaki more people were killed and injured by heat than by radioactivity. He points out that the heat from large fires or flash-like heat radiation from the atomic bomb may affect man by:

(1) Conduction and convection of hot air.

(2) Contact with hot objects.
(3) Radiation from hot areas and gases.
(4) Inhalation of hot air.

Each of these factors, either in itself or in combination with others, can attain high values, and the duration of the effect is the decisive factor.

Radiated Heat

Dr. Buettner first establishes that conduction and convection of hot air are not, as is so often assumed, the main transmitter of heat during a fire because of the vertical distribution of heat and the continuous convection exchange of cold and warm "air masses." (He is, of course, dealing with fires in the open air or fires which involve several structures and not those confined within a single building.) He next explains that protection against contact with hot objects can be secured by adequate covering of the body with materials resistant to ignition. This leaves, as items of principal concern, protection against heat radiation and the inhalation of hot air.

The seriousness of the radiation hazard to man depends upon the degree of absorption of heat by the skin and clothing. Other factors influencing the intensity of radiated heat are the angle of the radiation (as seen from the point exposed), the inclination of the area exposed and the "radiation" temperature of the radiating area itself. Skin and clothes will almost completely absorb heat radiations originating in fires of temperatures up to about 360°F (see Figure No. 1). White cloth surfaces and the skin reflect visible sunlight but *not* infra-red light originating from fires. Bright metals, on the other hand, reflect above 90 per cent of the intensity of infra-red light.

Heat Injuries

Dr. Buettner notes that heat injuries to man may be principally caused by:

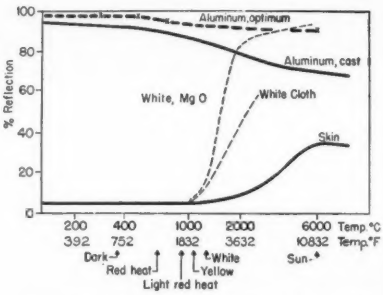


Figure No. 1. This diagram shows that only bright metals, such as aluminum, have efficient reflection qualities of flame (infra-red) radiation heat below 2700°F. The color notations correspond to visual flame impressions at various temperatures.

(1) Overcharging body heat balance.
(2) Heating of exposed skin.
(3) Ignition of hairs, clothes, etc.
(4) Inhaling hot air so that the respiratory organs are affected.

The heat balance of man is mainly influenced by that which enters the body through the skin and increases the peripheral blood flow. Profuse sweating may counteract (through "evaporation cooling" of the moisture) body overheating up to 140°F air temperatures (dry atmosphere). The protection afforded by perspiration is limited, however, by the body's water supply to the skin. In short exposures to very intense heat, the perspiration effect is probably negligible because the moisture does not have a chance to reach the outer surfaces of the skin or clothes to contribute to the cooling process by evaporation before burns occur. Further, the body seems to be unable to supply uncovered body parts with adequate moisture at the expense of those body parts protected by clothing.

Heating of the skin produces burns and pain, which also limit the time man may

expose himself, or be exposed, to heat. Calm, dry air heated to more than 280°F to 320°F, or an equivalent radiant heat, will cause unbearable pain to unprotected skin prior to a breakdown of the whole body. According to Dr. Buettner, if, by the effects of external heat, the body temperature of a man rises by more than 1.8°F, a normal individual will collapse. While such a collapse might not be fatal in itself, it might cause incapacitance leading to fatal results. From these hypotheses, Dr. Buettner believes he can predict the distance unprotected persons must stay from a fire to escape pain. This distance is usually equivalent to one and one-half times the diameter of the fire. At such a distance, skin pain might occur after 20 seconds exposure. He qualifies his statement by saying that even this exposure might cause serious enough pain to prevent a person from taking the necessary preventive measures to escape from the fire danger zone or to run through a fire to safety.

Inhalation of hot air may contribute to the overheating of the whole body and damage the respiratory organs. Smoke, dusts and gases, particularly carbon monoxide, have possibly even greater effects than the inhaled heated air. The toxic effects of fire gases are not, however, included in Dr. Buettner's research work.

Body Defense Against Heat

Protection of the body skin against radiant and conducted heat can be secured in varying degrees of efficiency by:

(1) Dry clothes and covering.
(2) Wet clothes and covering.
(3) Metal coated clothing.

The protection against heat that dry clothing can provide to man depends on its heat conductivity and its specific heat. The specific heat is almost the same for all kinds of cloth, including glass fabrics, and increases slowly with temperature. The finer the cloth, the less the heat conductivity of the material because of the high percentage of small air pockets found in such material. Pressure, such as is caused by weight or stress (as at the knees) increases the conductivity.

Water in clothing may increase the conductivity four to five fold. As to high temperature resistant materials, Dr. Buettner states that asbestos conducts more than three times the heat of an equal *thickness* of glass fabric, and more than ten times an equal *weight* of glass fabric. The heat conducted through all fabrics, unfortunately, increases with rises in the temperature of the fabrics and at high ambient temperatures, or under intense radiation heat conditions, clothes and hair may be set on fire. As long as the short time temperature of cotton clothes is below about 430°F, ignition does not occur, although with temperatures rising above 212°F discoloration may result (yellow turning into brown). Wool will scorch without burning and nylon will melt without burning. Glass fabrics can withstand temperatures of 1100°F or more, and asbestos 2100°F or more.

Wet clothes and coverings are protective because of the great cooling effect of water during evaporation. Maintenance of this protective evaporation process is difficult under high temperature exposures (unless water is constantly applied) and the benefits of wet clothes are therefore temporary. Remember also that water reduces the insulating quality of the clothes one-quarter.

Metal Coated Clothing

The above facts leave for consideration metal coated clothing. This type of clothing will provide the maximum benefits

Air Materiel Command

This photo has led some to believe that the aluminum foil suit, as presently developed, is recommended by the Air Forces for aircraft rescue and fire fighting. The test was intended to show only that the foil clothing provided resistance to radiation heat. The strips being exposed to heat by the man to the left are nitrocellulose film. In other pictures it could be observed that these strips ignited with flash fire intensity from the radiated heat. The fireman to the extreme right is protecting the wearer of a standard firemen's bunkin suit (with crash fire hood) by spray from a water-fog nozzle.

against the radiant heat hazard. This is principally due to the aforementioned quality of metal to reflect flame (infrared) radiation rays. The thickness of the metal would not appear significant in connection with its reflection powers, although it must be thick enough to be practical. Experiments with bronze-paint, sprayed or pulverized metal on adhesive bases, and electrolytic aluminum coating of rubber have not been successful, but it has been found practical to glue aluminum foil (0.00035 in. thick), on to textiles and artificial fabrics. The material in this form withstands crumpling without diminution of its heat reflecting power below 93%.

In 1943 comparative tests were conducted on heat radiation, and an aluminum suit was found far superior to a wet blanket and an asbestos suit. In 1944 a further test experiment was successfully performed. Later research showed that heat transmissions using a standard, dry, fireman's "bunkin" suit were 17.69 BTU's per sq. ft. per hour, while the Buettner aluminum suit was only 10.69 BTU's per sq. ft. per hour. Furthermore, the latter suit weighed only 8.32 lbs. compared to 22.05 lbs. for the dry "bunkin" suit. Glass fabric is suggested by Dr. Buettner as most suitable for aluminum foil application because of its heat resistance, lightness, and durability. Further research is in progress.

Utah Salt Works Fire

Plant managers sometimes ridicule recommendations of fire protection engineers calling for such features as fire protection for buildings of noncombustible construction processing noncombustible products, organization and regular training of a plant fire brigade, separate electric service lines for fire pumps, fussy details of pump suction and priming, protection of pipes against mechanical injury and freezing, and like features which the plant manager thinks are quite unnecessary, unreasonable and prohibitive in cost. But anyone present at the Morton Salt Co. plant at Saltair, Utah, on January 25, 1949, would be forced to admit that such recommendations are by no means foolish.

Sixteen buildings, ranging from 1 to 5 stories in height and for the most part of noncombustible construction, comprised this plant. The largest building of the group, the combination mill and warehouse, was made up of a 5-story mill section (ground floor area 6238 sq. ft.) surrounded on three sides by a 2-story warehouse section (ground floor 9611 sq. ft.). Walls and roof were corrugated asbestos on unprotected steel frame. Floors were 6- and 8-inch laminated wood on unprotected steel. Unprotected vertical openings interconnected all floors; and doorways protected by ordinary doors connected the two sections. (See diagram page 271.)

First aid extinguishers, standpipe hose lines (one on each floor of the mill section) and three yard hydrants with hose reels were available for fire fighting. A two-stage 500 gpm centrifugal electric fire pump supplied yard hydrants and standpipes from a 430,000-gallon reservoir

Based upon report submitted by Utah Fire Rating Bureau.

Utah Fire Rating Bureau

Private protection at this salt works, 10 miles from the nearest fire department, was all manually operated; yet there was no trained private fire brigade.

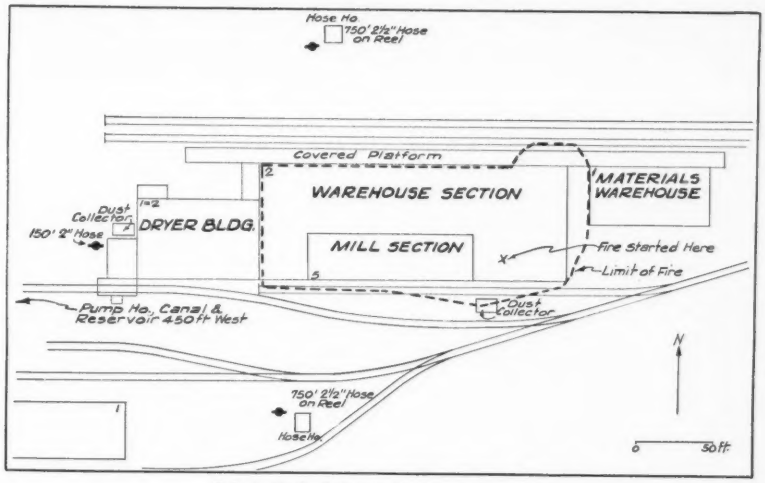
with a shallow canal as alternate supply. A 300 gpm single stage electric pump was provided as a standby. Watchmen were trained to start these pumps. Notwithstanding the fact that this rather extensive system of fire protection was all manually operated, the plant had no organized fire brigade and the nearest fire station was ten miles away.

Operations were normal on the day of the fire. A shipment of 60,000 paper salt cans had arrived in the morning and were taken to the second floor of the mill section for filling. As paper wrappings were removed from the bundles of cans, they were dumped in a pile in the undivided second floor of the communicating warehouse section where a large amount of other combustible material was stored, including 300 paper-wrapped bundles of paper salt cans, cardboard shooks for 75,000 boxes, 200,000 paper bags and between 250,000 and 300,000 burlap and cotton bags in bales.

At 3:00 P.M., a woman employee gathered up an armful of wrappings in the mill section and tossed them on the pile in the warehouse. No fire was noticeable at that time. On her return to the area 15 minutes later, however, the pile was in flames. Her shout of "fire" was the signal for most of the women employees in the second floor of the mill to run through the involved storage area to the rest room in the far corner to get coats before going into the below zero temperature. Two of the women after obtaining their belongings attempted to retrace their steps to the mill but were badly burned by the fast spreading fire, were overcome and had to be rescued. The others escaped with minor injuries by dropping from second floor warehouse windows to a roofed loading platform.

The plant siren was sounded and telephone calls for help were put through without appreciable delay. An employee in the adjoining dryer building who happened to have had watchman training ran to the pump house 700 ft. away and started the fire pump. Early attempts by other employees to use standpipe hose were abandoned when lines were found to be frozen. Hose was then laid from the yard hydrant north of the building, but fire had reached such proportions by then that the single line was unsuccessful. At 3:45 P.M., the first pumper arrived and immediately supplied three lines from the same yard hydrant, one to the exposed materials warehouse (12 ft. clearance), one to the division wall between the mill and an adjoining dryer building and one to the mill. The pumper had some difficulty in obtaining sufficient water for the three lines, but managed to supply them until the hydrant went dry without warning after 20 minutes. Loss of water was due to electric pump failure. On being told by the plant manager to disconnect power lines feeding the mill building, an employee had pulled the master switch at the sub-station, thus cutting off all power, including that for the pump.

During the brief period while power was off, the pump lost its prime. Pump operators thought the reservoir had been pumped dry and transferred suction to the canal connection, although it should have been obvious that the reservoir could not have been emptied in so short a time. When water was still unobtainable the real trouble was located. The pump could not be reprimed at once since the priming tank had not been refilled after the initial priming and the emergency supply normally available from a 6-inch pipe could not be used. The pipe had been run over



Saltair Utah, Salt Works Fire, January 25.

and broken by a truck. Finally a small gasoline pump was brought in and the fire pump reprimed, but by then approximately 1½ hours had elapsed. In the interim, a second pumper had arrived and attempted to take suction from the canal only to find the water too shallow to permit drafting. A sand bag dam was erected and the pumper was able eventually to supply two weak streams.

The fire continued to develop in intensity until 5:00 P.M. when the 5-story section collapsed. Thereafter, the fire was gradually brought under control and by 6:00 P.M., danger of further spread was eliminated. The fire was so intense that the 6- and 8-inch laminated wood floors were burned through in most areas.

In all, 7 pumpers responded, although 4 were returned to their stations because of the limited water supplies. Firemen (Salt Lake County Fire Department) did an excellent job in protecting the exposed materials warehouse and in cutting the fire off at the division wall between the mill and dryer buildings,—particularly in view of the limited water for hose streams and the extremely cold weather. Two engines pumped continuously until the afternoon of the next day.

Due to the extent of damage, there is little probability that the cause will be determined. However, careless disposal of cigarettes or matches are possible causes, since smoking was permitted on the premises.

Loss is conservatively estimated at $430,000 ($170,000 to building, $170,000 to machinery, and $90,000 to stock).

Two Fires Put Out, Third Disastrous

Fire Marshal, Oregon

The danger of running power lines to pumps over the roofs of buildings is shown in this fire. When these wires parted, two fire pumps were put out of service.

Twice on the night of January 12-13, 1949, fires due to wood in direct contact with a hot unlined chimney were extinguished without major loss. The third fire later the same night from the same cause proved disastrous. The luck that stopped the first two fires, despite various fire protection deficiencies, failed in the third. The property involved was the warehouse of the Utah Canning Co. at Freewater, Oregon. The loss is estimated at $560,000.

The 1-story, 100 ft. x 400 ft. warehouse was constructed of 8-inch hollow tile walls surmounted by a wood-frame, monitor-type roof covered with tar and roofing paper. An 8-inch hollow tile fire wall extending 3 ft. above the roof and dividing the structure into front and rear sections of equal area was pierced by two openings, each protected by a single automatic sliding-type fire door.

With the exception of a small partitioned-off office and an equipment storage room the front section was used exclusively for the storage of canned peas in cases, more than half of the cannery's 1948 pack being stacked to the monitored roof. The rest of the pack was stored in the rear section. The five coal-burning stoves that were installed in each section as protection against freezing were connected to unlined brick chimneys (two brick thickness) in the walls of the building. All stoves were being forced to the utmost on the night of January 12-13, when temperatures ranged from 11°F to 4°F.

Numerous first aid extinguishers, standpipe lines and hourly tours by an elderly watchman comprised the plant's private protection.

Volunteer Fire Departments were available in Freewater and the adjoining town of Milton. The water system was supplied from wells by two electrically operated pumps, one of 280 gpm capacity located in the rear of the fire station (five blocks from cannery), and the other of 850 gpm capacity located adjacent to the canning plant. The system is designed so that flow can be directed into the mains or diverted into a 128,000-gallon reservoir. In an emergency, discharge from the canning company's 1000 gpm electric pump which supplied water for canning operations could be diverted into the city mains. Unfortunately, the latter two pumps operated off the same bank of transformers and no provision was made to cope with a complete power failure in the area.

Based upon report submitted by Fire Marshal, Oregon.

Fire Marshal, Oregon

Stacked cases of peas with their cardboard coverings burned away are all that remains of the front warehouse section. The rear section where the first two fires started was saved from complete destruction in the third fire by the parapeted fire wall at the right.

Fire No. 1

On his 10 o'clock tour, the watchman saw a small patch of flame at the ceiling where wooden roof members rested directly against one of the stove chimneys in the rear section. He hurried to the office to telephone the alarm, then returned to the fire and attempted to place a 1½-in. standpipe line in operation. The line lacked 10 ft. of reaching around a corner of the stack of cases adjacent to the fire and was abandoned. By this time, flames were working along the ceiling and igniting cardboard cartons on the tops of stacks. The watchman felt helpless to do more, so returned to the office to await the fire department. No attempt was made to use any of the first-aid extinguishers provided, nor were fire doors checked.

Delay in assembling the town's fire crew caused by a blown fuse on the fire siren allowed fire to gain additional headway. On arrival, Freewater firemen placed two 1½-in. and one 2½-in. hydrant line in action and two men wearing masks entered the involved section to ascertain whether the fire doors in the division wall were closed. They found one door open, but were only partially successful in closing it before being overcome by smoke. Firemen from Milton also responded and the two departments, using one 2½-in. line and four 1½-in. lines had the fire out by midnight. Considerable damage had been done to cardboard cases in the areas adjacent to the point of origin.

Fire No. 2

Just as firemen were leaving, a second blaze was found burning in the rear section where the roof rafters came in contact with another stove chimney (see picture, page 274). The fire was promptly extinguished. This fire, as well as the first, was undoubtedly caused by an over-

Fire Marshal, Oregon

Construction of rafters and headers flush against unlined chimneys was the cause of two and possibly the third fire in this cannery warehouse. Damage from the second fire pictured above was insignificant because firemen were on the scene when it broke out.

heated unlined chimney igniting the rafters.

When it was possible to enter the rear section, inspection was made of the fire doors. One was open a foot; the cotton cord which suspended the closing weight had broken and become looped around the pulley. The door was closed at this time but the front section was found to be so heavily charged with smoke and heat due to the door mechanism failure that it was not deemed advisable to enter. Danger of freezing the pack precluded ventilating. Two employees were assigned to watch duty in the rear section and the regular watchman was instructed to continue his tours, but to bypass the front section.

Fire No. 3

The third fire was discovered in the front section by the watchman at 2:20 A.M., when a red glare was observed through the monitor windows. Fire broke through the monitor windows as he ran to sound the alarm and in an incredibly short time had involved the entire front storage section and was soon sweeping through the office. Although the cause of this third fire could not be ascertained because of the delayed detection and complete destruction, it was probably the same as in the first two fires.

Freewater and Milton again responded and laid hydrant lines in a vain attempt to save the office until records could be saved. It was at this time that the blaze destroyed the power lines running above the front warehouse section to the canning company's 1000 gpm electrically operated pump (see picture, page 272). In order to reduce the hazard of the downed live wires, it was necessary to cut off power into the company's bank of transformers. Since the city's 850 gpm electrically operated pump also was supplied through these same transformers, it too was put out of commission, placing the burden of furnishing water upon the small 250 gpm pump, plus gravity flow from the reservoir. Hydrant pressure was reduced to 45 psi, making hydrant lines of little value. There was extreme danger of extension of the blaze to the company's cannery across a 25 ft. clearance. Freewater used its hydrant lines to protect the cannery, while Milton, later aided by a company from Walla Walla, directed pumper streams at the fire wall to prevent spread to the rear storage section. Notwithstanding the limited manpower, equipment and water supplies that hindered operations, fire was kept from the cannery and the rear storage section and was under control by 4:00 A.M.

Fire Record of Cities, 1948

Fire departments of 502 United States cities and 51 Canadian cities of over 20,000 population have reported their estimates of fire loss, fire alarms, building fires, and false alarms for 1948 to the NFPA Department of Fire Records.

A total of 498 U. S. cities having more than 20,000 population reported a fire loss for the year 1948 of $185,322,079, amounting to an average loss per person of $3.45 for the 53,712,689 inhabitants of this group. The 1947 figure was $2.90.

Eighty-five fires were responsible for 22.5 per cent of the loss reported by these 498 U.S. cities. In the 51 Canadian cities six fires accounted for 18.5 per cent of the loss. Thus, elimination of the factors responsible for these few large fires (see article "Large Loss Fires of 1948," Jan. 1949 *Quarterly*) will cause a substantial decrease in the annual fire waste.

Fifty-one Canadian cities having a total population of 4,636,189 reported a total loss of $21,432,141 for 1948. This was a per capita loss of $4.62, as compared with $3.95 for Canadian cities in 1947.

A total of 484 U. S. cities reported both loss data and the number of building fires. The average loss per building fire in these cities for 1948 was $731, compared with $770 in 1947. The average loss per building fire for 42 Canadian cities was $807 in 1948, compared with $917 in 1947.

The total number of building fires reported by 494 U. S. cities was 243,157, an average of 4.43 fires per 1000 population, as compared with 4.20 building fires per 1000 population in 1947, and 4.27 in 1946. Forty-nine Canadian cities reported 25,022 building fires in 1948. The number per 1000 population was 5.65 in 1948, as compared with 4.33 in 1947.

Automobile fires (including trucks) reported by 485 U. S. cities totaled 76,991, an average of 1.42 fires per 1000 population. Forty-eight Canadian cities reported 2834 automobile fires, an average of 0.64 per 1000 population.

Fire departments in 501 U. S. cities of more than 20,000 population answered 709,656 alarms in 1948. The number of alarms answered by the fire departments in 50 Canadian cities was 51,682.

In the United States, 480 cities of over 20,000 reported 56,396 false alarms in 1948. This was 8.1 per cent of the total calls answered. It will be noted that these are "malicious false alarms" and not just cases where smoke or steam, etc., was honestly mistaken for fire. Forty-four Canadian cities reported 5443 malicious false alarms, or 11.0 per cent of their total calls.

The populations of many cities have changed since 1940. However, to keep the data comparable, we have used the 1940 U. S. census figures except in cases where the Census Bureau has issued recent official population estimates.

Fire departments have been very cooperative in furnishing fire loss figures. In a number of cases these are preliminary loss estimates and may be subject to upward revision when end-of-year fire losses are adjusted. Recent experience has shown that fire department estimates of loss based upon normal estimating procedures may be considerably below present-day values that are being reflected in adjusted fire loss payments. Further, many fire departments do not record indirect losses such as use and occupancy.

While there are occasional discrepancies in the manner in which certain cities report losses, our questionnaire calls for the total fire loss, both insured and uninsured, and this is the figure given unless otherwise indicated. Chimney and roof fires have been included in the number of building fires. A few cities do not give a complete record, but on the whole it is believed that these figures present a reliable indication of the relative trends in city fire losses in the United States and Canada. However, differences in methods of determining fire losses, of differentiating between alarms and building fires, and physical differences between cities may make any comparison between cities of limited value.

Fire losses reflect the composite results of many different factors in addition to fire department efficiency. Some cities have high losses due primarily to unfavorable structural conditions and unusual hazards, despite efficient fire departments.

1948 FIRE LOSSES, CITIES OF 20,000 POPULATION AND OVER

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
ALABAMA								
Anniston	25,523	34,349	259	128	23	11	5.0	1.85 (2)
Bessemer	22,826	53,473	194	83	33	1	3.6	2.73
Birmingham	267,583	907,810	3,491	1,143	404	333	4.3	2.99
Gadsden	36,975	158,982	636	252	67	37	6.8	4.26
Mobile	106,727	231,774	1,187	677	125	84	6.3	2.20
Montgomery	78,084	191,135	900	454	148	71	5.8	2.68
Phenix City	22,187	8,065b	158	51	27	3	2.3	0.36 (1)
Tuscaloosa	27,493	96,655	260	122	44	23	4.4	3.27
ARIZONA								
Phœnix	65,414	224,148	1,044	362	170	64	5.5	3.20
Tucson	36,818	335,682	712	257	82	107	6.4	7.42
ARKANSAS								
Fort Smith	36,584	95,422	864	206	82	30	5.6	4.42
Hot Springs	27,150	57,105	357	135	73	10	5.0	2.73
Little Rock	93,302	361,842	1,820	601	183	83	6.1	2.81
North Little Rock	39,552	349,807	744	200	70	15	5.1	4.17
Pine Bluff	21,290	125,548	521	210	68	1	9.9	4.26
CALIFORNIA								
Alameda	89,906	73,439	658	176	46	73	2.0	0.74
Alhambra	44,013	93,496	336	48	36	45	1.1	1.37 (3)
Bakersfield	32,807	67,750	647	183	108	63	5.6	5.61
Belvedere Twp.	37,192	....	....	....	....	....	....	....
Berkeley	103,315	168,188	1,691	627	103	84	6.1	2.18
Beverly Hills	28,217	123,470	405	122	28	22	4.3	5.19
Burbank	53,899	478,668	641	191	69	9	3.5	3.59
Compton	42,789	61,940	418	112	52	10	2.6	0.88 (3)
Coronado	25,382	7,373	119	30	12	10	1.2	0.43
Fresno	63,672	310,385	679	194	132	73	3.0	4.79
Glendale	96,495	129,310	909	217	110	63	2.2	2.58
Huntington Park	28,648	50,775	198	62	53	11	2.2	3.21
Inglewood	42,964	152,368	304	95	66	7	2.2	4.68
Long Beach	241,109	597,117	1,675	393	176	44	1.6	1.37
Los Angeles	1,805,687	4,177,022	21,894	6,214	2,306	1,506	3.4	2.51
Lynwood	20,650	31,592	193	44	18	21	2.1	1.20 (2)
Oakland	400,935	1,958,430	3,921	1,169	363	510	2.9	3.13
Palo Alto	22,789	16,000	274	97	17	12	4.3	0.64 (2)
Pasadena	98,279	209,505	963	299	161	65	3.0	1.41
Pomona	23,539	60,000	542	93	78	2	3.9	4.15
Redondo Beach	21,288	18,000	207	52	20	....	2.4	1.45 (2)
Richmond	101,519	53,882	793	198	78	67	1.9	1.23
Riverside	43,939	85,189	476	136	82	36	3.1	2.49
Sacramento	119,984	439,503	1,486	480	201	154	4.0	2.71
San Bernardino	56,193	325,386	714	205	93	16	3.6	3.23
San Diego	362,658	572,913	2,784	923	395	91	2.5	1.34
San Francisco	827,400	....	11.914	3,740	673	1,890	4.5	....
San Jose	68,457	194,877	996	298	124	24	4.4	2.74
San Leandro	26,701	304,718	262	76	53	2	2.9	2.91
San Mateo	32,580	323,303	445	150	48	13	4.6	4.26
Santa Ana	38,015	57,184	451	123	66	21	3.2	2.01
Santa Barbara	38,338	44,297	606	151	74	44	3.9	1.67
Santa Monica	67,473	510,003	863	228	96	86	3.4	2.71

b. Subject to change. (1) One year only. (2) Two year only. (3) Three year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
Santa Cruz	21,874	39,855	252	44	28	25	2.0	1.82 (1)
South Gate	46,000	59,736	847	115	100	7	2.5	1.67
Stockton	65,924	1,373,895a	1,074	263	128	29	4.0	8.93
Vallejo	20,072	59,971	683	190	64	91	9.5	1.92 (2)
COLORADO								
Colorado Springs	36,789	39,359	622	258	53	13	7.0	2.30
Denver	322,412	1,000,000a	4,247	2,409	486	423	7.5	2.22
Pueblo	52,162	42,680	2,566	397	145	32	7.6	1.29
CONNECTICUT								
Ansonia	20,000	56,814	102	32	12	6	1.6	3.28 (2)
Bridgeport	147,121	1,346,307	1,362	537	330	35	3.6	4.50
Bristol	30,167	88,317	332	160	35	13	5.3	2.44
Danbury	22,339	52,657	283	73	40	8	3.3	2.06
East Hartford	28,000	45,547	338	96	47	9	3.4	1.36 (2)
Fairfield	21,135	73,000	550	77	44	5	3.6	3.45 (1)
Greenwich	35,509	202,318	726	188	74	6	5.3	4.54
Hamden	23,373	55,295	382	42	55	6	1.8	1.92 (2)
Hartford	166,267	325,202	2,017	648	327	131	3.9	1.67
Manchester	23,799	....	....	....	....	....	....	....
Meriden	39,494	50,739	429	170	52	16	4.3	1.74
Middletown	26,495	19,864	189	91	48	5	3.4	1.25
New Britain	68,685	148,663	651	221	....	32	3.2	1.22
New Haven	160,605	410,813	2,483	822	260	147	5.1	3.94
New London	30,456	109,435	746	127	57	14	4.1	2.58
Norwalk	39,849	207,957	590	203	94	11	5.1	2.57
Norwich	23,652	74,391	306	158	27	10	6.7	1.86
Stamford	47,938	320,254	368	75	54	20	1.6	4.04
Stratford	22,580	24,405	342	79	86	3	3.5	2.97
Torrington	26,988	43,003a	126	....	....	11	....	1.25
Waterbury	99,314	203,590	1,267	384	107	27	3.9	2.48
West Hartford	33,776	102,155	399	185	53	6	5.5	1.47
West Haven Twp.	30,021	48,751	405	74	34	18	2.5	3.90
DELAWARE								
Wilmington	111,432	145,696	1,076	511	151	30	4.6	1.62
DISTRICT OF COLUMBIA								
Washington	833,720	2,080,725	9,425	3,041	1,004	1,287	3.7	1.88
FLORIDA								
Daytona Beach	22,584	146,125	355	141	44	12	6.3	6.18
Jacksonville	173,065	1,612,516a	2,464	726	230	116	4.2	6.33
Lakeland	22,068	14,840	395	101	49	14	4.6	0.64
Miami	172,172	1,135,480	3,428	455	216	199	2.6	4.03
Miami Beach	28,012	140,030	457	165	84	27	5.9	2.11
Orlando	36,736	34,375	422	27	30	22	0.7	1.42
Pensacola	37,449	269,266	549	230	51	24	6.1	4.48
St. Petersburg	60,812	86,663	1,559	220	75	12	3.6	1.69
Tampa	108,391	334,545	1,142	373	129	175	3.4	2.85
West Palm Beach	33,693	56,194	357	61	45	12	1.8	2.06
GEORGIA								
Athens	20,650	101,007	333	74	....	21	3.6	2.29
Atlanta	302,288	487,133	4,844	1,466	480	205	4.8	2.07
Augusta	65,919	273,810	915	504	151	46	7.7	3.38

a. Estimated. (1) One year only. (2) Two year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
GEORGIA (Cont'd)								
Columbus	53,280	56,277	568	298	128	52	5.6	1.02
La Grange	21,983	20,359	268	....	55	....	....	2.21
Macon	57,865	185,252	606	394	100	38	6.8	4.79
Rome	71,675	50,112	475	322	32	28	12.3	1.98
Savannah	95,996	....	....	....	....	....	....	....
IDAHO								
Boise	26,130	180,420	450	117	34	17	4.5	3.76
ILLINOIS								
Alton	31,255	128,700	413	205	79	5	6.7	9.01
Aurora	47,170	106,682	748	282	85	17	6.0	2.17
Belleville	28,405	25,308	442	109	68	3	3.8	1.56
Berwyn	48,451	9,605	470	92	45	5	1.9	0.41
Bloomington	32,868	31,662	443	138	68	2	4.2	2.35
Champaign	23,302	82,000	362	287	32	9	12.3	1.94
Chicago	3,396,808	9,000,000	40,046	11,954	5,222	5,228	3.5	2.24
Chicago Heights	22,461	44,397	192	117	21	3	5.2	4.24
Cicero	64,712	426,505	966	188	111	74	2.9	4.71
Danville	36,919	112,576	526	117	43	7	3.2	3.57
Decatur	59,305	98,910	697	355	145	10	6.0	2.94
East St. Louis	75,609	150,218	1,218	543	118	100	7.2	2.96
Elgin	38,333	97,016	440	105	68	20	2.7	2.40
Evanston	65,389	296,008	732	277	76	75	4.2	1.91
Freeport	22,366	129,839	316	80	5	27	3.6	1.76
Galesburg	28,876	122,800	357	140	48	6	4.8	7.11
Granite City	22,974	53,735	251	148	42	2	6.5	4.32
Joliet	42,365	156,139	664	234	25	25	5.5	4.15
Kankakee	22,241	45,680	442	62	42	11	2.8	4.49
Maywood	26,648	31,545	169	102	40	16	3.8	1.03
Moline	34,608	50,507	476	191	69	47	5.5	1.58
Oak Park	66,015	46,230	956	253	84	7	3.8	0.59
Peoria	105,087	180,739	1,522	572	227	123	5.6	2.75
Quincy	40,469	51,000	704	296	90	22	7.3	2.23
Rockford	84,673	510,330	1,338	582	170	24	6.9	5.57
Rock Island	42,775	88,506	698	288	61	24	6.7	1.94
Springfield	75,503	2,396,115	1,121	....	....	23	....	8.94
Waukegan	34,241	54,007	815	276	76	28	8.1	4.47
INDIANA								
Anderson	41,572	140,839	769	552	115	42	13.6	3.29
Bloomington	20,447	24,800	360	110	....	21	5.4	1.22
East Chicago	54,637	366,174	955	424	88	85	7.8	6.52
Elkhart	33,434	213,322	792	339	78	25	10.1	5.17
Evansville	97,062	523,933	1,697	757	99	121	7.8	5.10
Fort Wayne	118,410	160,000	2,279	461	226	190	3.9	1.64
Gary	111,719	....	....	....	....	....	....	....
Hammond	70,184	265,640	1,293	742	75	54	10.6	4.77
Indianapolis	386,972	1,033,753	4,854	2,259	789	441	5.8	2.40
Kokomo	33,795	330,440	511	237	94	12	7.0	3.81
Lafayette	28,798	65,659	520	352	95	24	12.2	3.84
Logansport	20,177	12,183	521	293	54	39	14.5	0.44
Marion	26,767	141,325	437	252	76	29	9.4	4.00
Michigan City	26,476	16,588	584	244	55	11	9.2	1.91
Mishawaka	28,298	55,878	399	151	47	54	5.3	1.20
Muncie	49,720	208,463	1,009	369	142	63	7.4	6.19
New Albany	25,414	182,010	458	287	39	33	11.3	4.01
Richmond	35,147	27,807	671	309	71	36	8.8	0.92
South Bend	101,268	429,123	1,687	682	194	162	6.7	3.29
Terre Haute	62,693	85,000	1,251	551	127	40	8.8	2.02

a. Estimated.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
IOWA								
Burlington	25,832	65,233	551	168	55	12	6.5	4.54
Cedar Rapids	62,120	199,385	767	392	92	33	6.3	2.96
Clinton	26,270	58,353	472	294	67	14	11.2	2.54
Council Bluffs	41,439	65,746	625	242	73	40	5.8	2.52
Davenport	66,039	242,389	873	164	116	57	2.5	2.19
Des Moines	159,819	1,654,838	2,551	725	331	118	4.5	6.04
Dubuque	43,892	121,461	1,117	431	101	22	9.8	2.92
Fort Dodge	22,904	221,913	406	141	50	9	6.2	6.28
Mason City	27,080	45,055	448	127	60	....	4.7	1.41
Ottumwa	31,570	353,019	542	251	94	1	8.0	4.92
Sioux City	82,364	372,410	1,255	540	164	66	6.6	4.57
Waterloo	51,743	89,699	863	367	125	118	7.1	3.02
KANSAS								
Hutchinson	30,013	125,480	697	171	89	8	5.7	4.87
Kansas City	121,458	171,416	2,103	773	261	107	6.4	1.43
Salina	21,073	254,115	439	50	54	7	2.4	6.89
Topeka	67,833	170,863	1,036	263	152	71	3.9	2.11
Wichita	114,966	260,735	2,092	507	268	58	4.4	2.20
KENTUCKY								
Ashland	29,537	....	....	....	....	....	....	....
Covington	62,014	32,155	678	251	96	23	4.0	1.32
Lexington	49,304	387,522	700	274	120	30	5.6	7.65
Louisville	319,077	823,347	3,993	2,113	541	177	6.6	1.78
Newport	30,631	74,361	401	347	40	23	11.3	1.90
Owensboro	30,245	213,378c	666	289	91	15	9.6	2.48
Paducah	33,765	238,262	911	235	63	44	7.0	2.96
LOUISIANA								
Alexandria	27,066	163,450	455	203	44	30	7.5	5.06
Baton Rouge	34,719	90,199	404	41	81	41	1.2	1.74
Lake Charles	21,207	58,738	278	86	37	48	4.1	3.57 (3)
Monroe	28,309	110,857	873	241	50	15	8.5	4.37
New Orleans	494,537	1,196,749a	4,119	1,288	215	232	2.6	1.86
Shreveport	98,167	272,016	1,348	427	121	47	4.4	3.73
MAINE								
Bangor	29,822	263,884	638	465	95	44	15.6	5.37
Lewiston	38,598	112,998	863	459	61	2	11.9	4.24
Portland	73,643	68,312	1,436	261	85	62	3.5	3.12
MARYLAND								
Baltimore	859,100	4,104,804	10,858	5,894	1,406	733	6.9	3.86
Cumberland	39,483	94,871	402	257	61	24	6.5	2.18
Hagerstown	32,491	....	463	258	5	26	7.9	....
MASSACHUSETTS								
Arlington	40,013	341,601	710	....	58	....	....	3.08
Attleboro	22,071	28,627	465	65	33	12	2.9	3.14
Belmont	26,867	19,552	505	160	40	23	6.0	1.06
Beverly	25,537	113,271	846	263	59	12	10.3	3.66
Boston	770,816	....	13,814	3,798	1,241	2,066	4.9	....
Brockton	62,343	169,747	1,378	391	89	51	6.3	2.79
Brookline	56,940	....	....	....	....	....	....	....
Cambridge	110,879	565,008	2,174	965	154	260	8.7	3.70
Chelsea	41,259	109,562	983	346	56	106	8.4	3.68
Chicopee	41,664	66,755	762	166	52	32	4.0	2.05
Everett	46,784	956,149	964	155	66	87	3.3	6.77
Fall River	115,428	364,486	1,292	361	132	58	3.1	2.87

a. Estimated. c. Insured losses only. (3) Three year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
MASSACHUSETTS (Cont'd)								
Fitchburg	41,824	159,229	792	236	85	21	5.6	3.41
Framingham	23,214	127,118	681	79	43	31	3.4	8.39
Gardner	20,206	50,071	339	202	26	3	10.0	4.38
Gloucester	24,046	170,812	655	180	16	19	7.5	6.74
Haverhill	46,752	207,343	1,226	213	70	76	4.6	4.23
Holyoke	53,750	142,700	1,104	504	9	52	9.4	3.08
Lawrence	84,323	172,871b	1,450	265	138	63	3.1	2.10
Leominster	22,226	36,878	388	....	28	3	....	2.73
Lowell	101,389	364,358	1,531	410	130	49	4.0	2.42
Lynn	98,123	279,638b	2,265	614	161	183	6.2	3.64
Malden	58,010	119,000a	1,127	121	63	57	2.1	2.80
Medford	63,083	124,429	1,219	99	20	56	1.7	2.50
Melrose	25,333	54,290	597	47	32	6	1.9	1.81
Methuen	21,880	40,474	630	129	36	4	5.9	2.33
New Bedford	110,341	141,206	1,143	392	110	70	3.6	1.67
Newton	69,873	103,696	1,295	334	118	75	4.8	1.18
North Adams	22,213	55,114	294	169	12	12	7.6	3.22
Northampton	24,794	91,523a	362	219	42	9	8.8	3.92
Peabody	21,711	96,737	515	130	45	25	6.0	5.10
Pittsfield	49,684	123,551b	743	331	56	24	5.5	2.16
Quincy	75,810	389,582	2,022	369	128	99	4.9	4.01
Revere	34,405	266,240	1,077	63	4	125	1.8	4.74
Salem	41,213	121,960	914	190	79	....	4.6	2.56
Somerville	102,177	194,067a	2,038	348	187	210	3.4	2.09
Springfield	149,554	768,480	2,471	546	193	195	3.6	4.65
Taunton	37,395	48,697	643	185	41	18	5.0	2.63
Waltham	40,020	442,642	1,062	169	69	93	4.2	4.86
Watertown	35,427	83,795	544	152	62	25	4.3	2.06
Weymouth	23,868	73,551	650	139	72	24	5.8	6.77
Worcester	193,694	836,775	4,025	2,133	252	359	11.0	3.22
MICHIGAN								
Ann Arbor	29,815	101,577	528	82	71	9	2.7	3.53
Battle Creek	43,453	195,373	1,024	276	101	98	6.4	4.66
Bay City	47,956	206,460	927	221	94	24	4.6	3.07
Dearborn	72,985	757,449	1,040	212	144	127	2.9	6.11
Detroit	1,654,972	8,709,085	19,096	7,857	2,488	1,997	4.7	3.69
Ferndale	27,392	125,752	360	150	55	12	5.5	2.12
Flint	151,543	390,972	1,837	699	173	265	4.6	2.10
Grand Rapids	164,292	585,330	1,851	1,435	162	103	8.7	3.64
Hamtramck	52,470	103,897	547	395	90	62	7.5	4.22
Highland Park	50,810	114,174	737	232	108	58	4.6	3.05
Jackson	49,656	121,013	776	391	103	48	7.9	3.10
Kalamazoo	54,097	541,247	856	485	114	74	9.0	5.94
Lansing	78,753	156,399	2,098	312	224	95	4.0	3.31
Muskegon	50,215	186,385	604	339	63	26	6.8	8.16
Pontiac	73,752	325,545	843	376	130	86	5.1	3.46
Port Huron	32,759	190,099	746	465	89	37	14.2	4.86
Royal Oak	35,319	54,150	557	147	77	51	4.2	2.28
Saginaw	82,794	356,024	1,262	380	170	77	4.6	2.99
Wyandotte	30,618	75,519	563	309	109	57	4.1	2.37
MINNESOTA								
Duluth	101,065	1,110,626	1,625	264	78	77	2.6	3.82
Minneapolis	492,370	3,047,571	6,066	3,277	713	233	6.7	6.52
Rochester	26,312	31,927	440	137	60	70	5.2	1.73
St. Cloud	24,173	125,400	330	193	32	7	8.0	3.81
St. Paul	287,736	953,311	4,643	1,087	531	231	3.8	2.47
Winona	22,490	47,231	380	235	45	10	10.4	4.36

a. Estimated. b. Subject to change.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
MISSISSIPPI								
Greenville	20,890	48,225	338	181	37	5	8.7	1.71
Hattiesburg	21,026	44,693	382	101	45	13	4.8	2.52
Jackson	62,107	43,690	785	338	....	26	5.4	3.16
Laurel	20,598	45,000	179	132	19	10	6.4	3.17
Meridian	35,481	132,817	552	270	96	17	7.6	3.66
Vicksburg	24,460	45,075	490	88	40	16	3.6	0.86
MISSOURI								
Hannibal	20,865	33,434	246	85	50	7	4.1	2.02
Jefferson City	24,268	13,441	350	197	46	13	8.1	0.41
Joplin	37,144	101,787	977	341	94	64	9.2	2.05
Kansas City	399,178	1,649,858	6,118	2,116	845	399	5.3	3.22
St. Joseph	75,711	450,000a	1,565	387	252	51	5.0	4.17
St. Louis	822,630	1,412,796e	6,592	2,305	786	736	2.8	2.08
Sedalia	20,428	222,758	359	187	50	1	9.2	4.41
Springfield	61,028	147,934	1,326	538	134	49	8.8	5.38
University City	33,023	109,265	695	204	42	7	6.2	1.40
MONTANA								
Billings	23,024	152,069	348	102	32	32	4.4	3.91
Butte	37,081	200,000	448	96	32	119	2.6	3.44
Great Falls	29,928	258,919	433	92	16	36	3.1	3.34
NEBRASKA								
Lincoln	81,984	27,035a	1,266	454	211	15	5.5	1.75
Omaha	223,844	987,844	3,103	1,147	440	114	5.1	3.23
NEVADA								
Reno	21,317	311,849	1,176	91	64	11	4.3	7.36
NEW HAMPSHIRE								
Concord	27,171	218,975	576	271	61	15	10.0	4.48
Manchester	77,685	513,713b	1,381	364	102	36	4.7	6.61 (1)
Nashua	32,927	125,172	582	231	....	10	7.0	5.07
NEW JERSEY								
Atlantic City	64,094	446,287	719	472	90	155	7.4	9.15
Bayonne	79,198	121,342	846	578	90	59	7.3	3.08
Belleville	28,167	28,270	328	112	57	10	4.0	1.49
Bloomfield	41,623	47,021	537	158	63	15	3.8	1.95
Camden	117,536	138,946	1,373	392	157	80	3.3	1.87
Clifton	48,827	261,161	601	86	67	40	1.8	5.96
East Orange	68,945	232,896	707	265	104	57	3.8	2.23
Elizabeth	109,912	132,453	904	341	141	63	3.1	1.33
Garfield	28,044	14,610	99	41	20	3	1.5	0.67
Hackensack	26,279	109,964	419	106	46	10	4.0	2.93
Hoboken	50,115	212,835	800	281	57	24	5.6	2.96
Irvington	55,328	142,491	395	171	92	22	3.1	2.33
Jersey City	301,173	439,412	2,940	1,457	284	329	4.8	1.20
Kearny	39,467	89,517	368	93	37	27	2.4	14.85
Linden	24,115	33,796	465	177	51	9	7.3	1.52
Maplewood	23,139	15,510b	228	117	30	15	5.1	1.09
Montclair	39,807	50,462	468	220	70	21	5.5	1.45

a. Estimated. b. Subject to change. e. Estimated, April 1, 1947-Dec. 31, 1948.

(1) One year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
NEW JERSEY (Cont'd)								
Newark	429,760	1,629,933	4,695	2,300	1,001	497	5.4	4.11
New Brunswick	33,180	137,138	530	169	56	19	5.1	5.38
North Bergen	39,714	15,380	703	89	62	10	2.2	0.96
Nutley	21,954	40,812	447	77	40	17	3.5	2.20
Orange	35,717	36,545	390	63	44	37	1.8	3.12
Passaic	61,394	477,056	1,632	342	91	72	5.6	5.61
Paterson	139,656	287,866	1,354	770	186	65	5.5	2.50
Perth Amboy	41,242	182,058	217	94	50	22	2.3	6.27
Plainfield	37,469	56,462	593	178	58	30	4.8	3.77
Teaneck Twp.	25,275	53,836	642	109	46	12	4.3	1.54
Trenton	124,697	639,195	1,136	553	194	52	4.4	2.68
Union City	56,173	147,900	613	236	56	62	4.2	1.78
Union Twp.	24,730	47,355	451	148	58	....	6.0	1.67
West New York	39,439	43,188	520	87	....	31	2.2	1.22
West Orange	25,662	49,063c	241	71	51	10	2.8	1.07
Woodridge	27,191	....	....	....	....	....	....	....
NEW MEXICO								
Albuquerque	35,449	....	....	....	....	....	....	....
Santa Fe	20,325	20,500	159	21	12	3	1.0	0.92
NEW YORK								
Albany	130,577	....	....	....	....	....	....	....
Amsterdam	33,329	16,286	394	109	26	7	3.3	2.08
Auburn	35,753	44,296	425	160	....	19	4.5	2.15
Binghamton	78,309	152,531	857	275	....	22	3.5	2.60
Buffalo	575,901	2,638,627	6,870	1,363	564	170	2.4	2.81
Cohoes	21,955	128,025	290	92	27	7	4.2	3.27 (3)
Elmira	45,106	106,644	438	197	54	21	4.4	2.90
Freeport	20,400	32,000a	209	74	25	13	3.6	5.05 (4)
Gloversville	23,329	113,790	300	82	24	10	3.5	2.92
Hempstead	20,856	554,542	370	103	37	21	4.9	8.66
Jamestown	42,638	105,506	667	148	....	17	3.5	2.54
Kingston	28,589	28,505	522	203	66	28	7.1	1.42
Lackawanna	24,058	70,641	286	61	40	36	2.5	2.14
Lockport	24,379	83,105	417	137	33	10	5.6	3.74
Middletown	21,908	20,388	230	66	33	3	3.0	1.47 (3)
Mount Vernon	67,362	183,113	744	217	42	43	3.2	1.45
Newburgh	31,883	38,393	288	205	43	13	6.4	2.14
New Rochelle	58,408	115,973	611	267	102	12	4.6	1.84
New York	7,454,995	19,784,125	57,949	20,825	6,180	11,037	2.8	2.24
Niagara Falls	78,029	147,934	1,047	272	226	62	3.5	1.49
North Tonawanda	20,254	41,787	295	95	27	4	4.7	3.61
Olean	21,506	36,242	354	74	39	8	3.4	1.03
Oswego	22,062	....	....	....	....	....	....	....
Port Chester	23,073	24,600	247	105	37	11	4.5	2.28 (4)
Poughkeepsie	40,478	129,689	440	204	63	43	4.9	2.54
Rochester	324,975	762,605	3,450	860	351	126	2.6	1.92
Rome	34,214	27,334	515	124	48	41	3.6	1.60
Schenectady	87,549	614,707	1,153	318	153	82	3.6	2.60
Syracuse	205,967	927,398	2,079	714	299	210	3.5	4.05
Troy	70,304	196,774	1,060	395	90	19	5.6	2.66
Utica	100,518	533,367	851	338	214	34	3.4	3.26
Watertown	33,385	82,274	517	257	47	37	7.7	2.78
White Plains	40,327	73,743	435	136	79	15	3.4	1.62
Yonkers	142,598	387,644	1,917	968	174	81	6.8	1.86

c. Insured loss only. (3) Three year only. (4) Four year only. a. Estimated.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
NORTH CAROLINA								
Asheville	51,310	306,244	784	323	71	62	6.3	3.18
Burlington	21,830	73,870	276	73	38	9	3.3	3.89 (3)
Charlotte	100,899	434,127	1,702	974	243	128	9.6	4.21
Durham	60,195	98,468	683	352	102	35	5.8	2.75
Gastonia	21,313	95,580	248	94	46	94	4.4	3.22
Greenboro	59,319	128,235	873	303	131	98	5.1	2.33
High Point	38,495	178,901	498	238	89	32	6.2	3.90
Raleigh	46,897	320,626	824	343	71	92	7.3	2.69
Rocky Mount	25,568	46,407	302	169	44	4	6.6	1.45
Wilmington	47,483	535,022	608	381	53	91	8.0	4.32
Winston-Salem	79,815	152,904	806	157	101	56	2.0	3.71
NORTH DAKOTA								
Fargo	32,580	221,365	547	356	17	18	10.9	2.53
Grand Forks	20,228	259,168	309	76	24	12	3.8	7.77
OHIO								
Akron	244,791	732,339	2,609	738	386	297	3.0	2.72
Alliance	22,405	....	....	....	....	....	....	....
Ashtabula	21,405	35,446	379	52	36	14	2.4	4.20
Barberton	24,028	137,122	404	120	36	78	5.0	3.73
Canton	108,401	178,404	1,034	347	147	83	3.2	2.63
Chillicothe	22,000	30,283	239	44	40	11	2.0	4.81
Cincinnati	455,610	1,168,686	7,029	1,961	823	347	4.3	2.01
Cleveland	878,336	4,136,637	9,505	2,793	1,043	842	3.2	5.41
Cleveland Heights	58,000	26,491	790	213	43	5	3.7	0.59
Columbus	306,087	990,024	10,039	2,017	786	43	6.6	2.46
Cuyahoga Falls	20,546	107,261	380	103	46	24	5.0	1.80
Dayton	210,718	335,410	2,926	757	428	287	3.6	2.21
East Cleveland	39,495	12,660	393	108	55	10	2.7	1.36
East Liverpool	23,555	14,851	404	175	77	13	7.4	1.49
Elyria	25,120	263,703	247	49	18	1	1.9	4.11
Findlay	20,228	299,520	270	109	50	14	5.4	8.12
Hamilton	50,592	86,823	1,001	276	116	35	5.5	2.11
Lakewood	69,160	47,155	318	82	46	41	1.2	0.97
Lancaster	21,940	25,280	391	108	44	49	4.9	2.97
Lima	44,711	175,701	806	236	128	23	5.3	4.51
Lorain	44,125	533,236	670	166	63	56	3.8	3.94
Mansfield	37,154	83,642	591	316	79	51	8.5	4.68
Marion	30,817	49,590	426	316	68	7	10.6	1.85
Massilon	26,644	25,450	466	121	55	19	4.9	1.28
Middletown	31,220	69,858	481	224	73	34	7.2	2.72
Newark	31,487	27,483	495	136	102	16	4.3	1.96
Norwood	34,010	29,795	273	119	88	10	3.5	0.91
Portsmouth	40,466	28,000a	400	182	94	30	4.5	2.28
Sandusky	24,874	77,280	753	241	64	13	9.7	2.57
Shaker Heights	23,393	36,648	382	144	43	21	6.2	2.38
Springfield	70,662	939,185	1,028	549	140	44	7.8	6.33
Steubenville	37,651	38,066	393	193	32	38	5.1	1.31
Toledo	282,349	1,181,408	3,077	1,111	527	375	3.9	2.78
Warren	42,837	117,295	560	191	104	37	4.5	2.43
Youngstown	167,720	504,695	1,528	404	182	94	2.4	2.09
Zanesville	37,500	42,905	419	164	101	50	4.4	2.07
OKLAHOMA								
Enid	28,081	66,239	409	143	87	44	5.1	2.72
Muskogee	32,323	101,492	1,017	265	67	33	8.2	2.69
Oklahoma City	204,424	345,825	3,944	....	....	77	....	1.67
Shawnee	22,053	237,152	528	90	60	12	4.1	5.03
Tulsa	142,157	395,752	3,098	722	....	146	5.1	2.75

a. Estimated. (3) Three year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
OREGON								
Eugene	20,838	94,181	638	489	58	5	23.5	8.74
Portland	363,141	1,219,743	4,813	3,164	346	289	8.7	4.26
Salem	30,908	97,447	494	331	37	....	10.7	11.67
PENNSYLVANIA								
Abington Twp.	20,857	....	....	....	....	....	....	....
Aliquippa	27,023	19,230	179	101	34	11	3.7	0.51
Allentown	96,904	87,183	328	237	72	19	2.3	1.17
Altoona	80,214	....	....	....	....	....	....	....
Bethlehem	58,490	14,981	236	97	40	6	1.7	0.86
Butler	24,477	282,525	242	122	42	7	5.0	3.82
Chester	59,285	1,040,151	528	235	70	26	4.0	....
Dunmore	23,086	23,000	118	24	31	14	1.0	1.04
Duquesne	20,693	....	....	....	....	....	....	....
Easton	33,589	285,565	168	106	29	9	3.2	2.87
Erie	116,955	189,825	1,286	476	140	72	4.1	2.38
Harrisburg	83,893	59,214	523	321	96	19	3.8	1.91
Haverford Twp.	27,594	....	....	....	....	....	....	....
Hazelton	38,009	121,868	155	67	27	5	1.9	3.56
Johnstown	66,668	112,998	701	310	78	75	4.7	0.76
Kingston	20,679	17,900	156	19	30	5	0.9	0.85
Lancaster	61,345	109,741	315	178	45	29	2.9	6.07
Lebanon	27,206	46,027	104	55	21	....	2.0	5.31
Lower Marion Twp.	39,566	234,023	485	125	45	1	3.2	5.09
McKeesport	55,355	31,300	547	233	68	53	4.2	2.44
Monessen	20,257	83,850	96	24	10	3	1.2	5.64
Nanticoke	24,387	....	....	....	....	....	....	....
New Castle	47,638	37,362	540	237	91	28	5.0	3.16
New Kensington	24,055	....	....	....	....	....	....	....
Norristown	38,181	9,716	158	57	35	3	1.5	0.46
Oil City	20,379	17,005	175	72	40	2	3.5	2.86
Philadelphia	1,931,334	7,270,495a	14,885	5,348	1,837	1,419	2.8	3.29
Pittsburgh	671,659	....	....	....	....	....	....	....
Pottstown	20,194	29,616	39	26	....	4	1.3	3.14
Pottsville	24,530	46,464	119	59	21	2	2.4	1.59
Reading	110,568	157,423	647	387	43	35	3.5	1.71
Scranton	140,404	200,000a	1,053	300	120	116	2.1	2.44
Sharon	25,622	....	....	....	....	....	....	....
Uniontown	21,819	22,291	274	81	45	3	3.7	2.66(4)
Upper Darby	56,883	231,279	285	122	35	5	2.1	2.29
Washington	26,166	16,060	242	86	46	23	3.3	1.78
Wilkes-Barre	86,236	138,758	559	204	74	61	2.4	3.83
Wilkinsburg	29,853	58,875	206	140	34	32	4.7	2.37(3)
Williamsport	44,355	75,509	339	128	51	17	2.9	2.38
York	56,712	85,250	264	169	44	39	3.0	3.66
RHODE ISLAND								
Central Falls	25,121	35,623b	265	45	30	11	1.8	1.41(3)
Cranston	47,173	75,477	840	143	64	24	3.0	1.68
East Providence	32,093	276,837	627	130	52	35	4.1	3.86
Newport	30,402	39,642c	418	202	40	18	6.6	1.33
Pawtucket	75,449	421,976	1,315	383	131	87	5.1	3.63
Providence	253,214	823,810	3,956	639	139	423	2.5	2.36
Warwick Twp.	28,616	52,653	647	159	54	10	5.6	2.04(3)
Woonsocket	49,204	65,727	561	164	....	32	3.3	2.90

a. Estimated. (3) Three year only. (4) Four year only. b. Subject to change.
c. Insured only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
SOUTH CAROLINA								
Charleston	81,347	169,216	903	342	63	124	4.2	3.48
Columbia	62,396	276,053	1,006	519	149	44	8.3	3.22
Greenville	34,734	443,359	675	360	130	69	10.4	13.10
Spartanburg	32,249	155,113	674	192	139	64	6.0	7.11
SOUTH DAKOTA								
Sioux Falls	40,832	658,735	543	185	103	13	4.5	4.05
TENNESSEE								
Chattanooga	128,163	314,757	1,834	828	205	191	6.5	2.94
Jackson	24,332	113,805	390	....	....	....	....	3.53
Johnson City	25,353	114,355	491	118	53	3	4.7	3.73
Knoxville	111,580	297,080	1,953	832	237	93	7.5	1.85
Memphis	292,942	912,082	4,670	1,029	638	147	3.5	3.52
Nashville	167,402	600,230	3,199	952	301	191	5.7	3.55
TEXAS								
Abilene	26,612	95,000	593	77	82	35	2.9	3.71
Amarillo	51,686	237,236	861	231	61	45	4.5	3.50
Austin	87,930	379,046b	1,654	376	252	22	3.3	2.32
Beaumont	77,335	150,000a	1,431	791	129	79	10.2	2.77
Brownsville	22,083	52,555	212	47	32	14	2.1	1.90
Corpus Christi	57,301	250,143	1,046	283	105	123	4.9	3.53
Dallas	294,734	2,525,870	8,202	983	717	323	3.3	6.36
El Paso	96,810	175,000a	1,189	640	129	106	6.6	1.91
Fort Worth	177,662	1,036,989	5,342	1,469	326	218	8.3	5.41
Galveston	60,862	173,073	843	258	83	186	4.2	4.91
Houston	384,514	1,802,691a	6,865	2,047	697	670	5.3	4.20
Laredo	39,274	20,783	328	98	49	4	2.5	1.27
Lubbock	31,853	115,000a	581	314	172	....	9.9	3.44
Port Arthur	56,065	125,501	434	118	49	47	2.1	1.65
San Angelo	25,802	66,766	490	263	55	31	10.2	2.58
San Antonio	253,854	940,532	3,453	1,187	435	120	4.7	3.32
Tyler	28,279	168,490	648	103	....	8	3.6	3.87
Waco	55,982	786,889	963	390	145	26	7.0	5.83
Wichita Falls	45,112	423,830	831	254	80	61	5.6	10.25
UTAH								
Ogden	43,688	207,052	1,322	187	69	42	4.3	3.10
Salt Lake City	149,934	730,520	2,156	655	183	50	4.4	2.57
VERMONT								
Burlington	27,686	....	613	325	60	50	11.7	....
VIRGINIA								
Alexandria	49,584	56,000	558	319	81	16	6.4	2.85
Arlington County	57,040	149,550a	1,105	425	168	36	7.5	1.62 (3)
Danville	32,749	95,771	318	178	72	9	5.4	6.48
Lynchburg	44,541	123,203	669	375	96	51	8.4	3.20
Newport News	45,599	68,031	607	310	75	36	6.8	5.85
Norfolk	231,949	872,532	2,953	1,502	233	369	6.5	3.37
Petersburg	30,631	147,510	720	680	20	38	20.2	2.72
Portsmouth	81,951	191,969	1,022	299	53	130	3.7	2.93
Richmond	222,818	628,728	3,305	2,035	507	137	9.1	1.32
Roanoke	69,287	156,957	861	466	95	74	6.7	2.47

a. Estimated. b. Subject to change. (3) Three year only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
WASHINGTON								
Bellingham	29,314	187,706	776	507	49	13	17.3	5.86
Everett	30,224	263,200	742	480	47	38	15.8	3.35
Seattle	434,204	406,007	5,254	2,086	452	327	4.8	1.38
Spokane	122,001	698,064	2,002	952	135	105	7.8	4.82
Tacoma	129,302	291,863	2,094	1,444	139	162	11.0	6.51
Yakima	27,221	452,580	535	274	72	14	10.1	8.35
WEST VIRGINIA								
Bluefield	20,641	55,910	252	56	21	....	2.7	3.00
Charleston	67,914	58,000	515	189	105	115	2.8	5.44
Clarksburg	30,579	8,021	291	156	42	9	5.1	1.01
Fairmont	23,105	....	....	....	....	....	....	....
Huntington	78,836	249,664	1,204	449	128	122	5.7	5.26
Parkersburg	30,105	36,423	256	65	43	8	2.2	1.49
Wheeling	61,099	65,669	696	230	89	31	3.8	2.80
WISCONSIN								
Appleton	28,436	55,069	556	277	54	32	9.7	2.27
Beloit	25,365	34,000a	576	297	41	38	11.7	1.40
Eau Claire	30,745	637,017	663	184	124	34	6.0	7.41
Fond du Lac	27,209	66,303	469	284	51	27	10.4	6.96
Green Bay	46,235	353,167	765	291	90	48	6.3	2.68
Janesville	22,992	494,747	502	252	6	12	11.0	5.75
Kenosha	48,765	130,871	1,027	296	86	11	6.1	2.80
La Crosse	42,707	341,342	700	419	89	5	9.8	4.39
Madison	67,447	98,553c	965	311	139	12	4.6	2.08
Manitowoc	24,404	46,696	340	156	18	16	6.4	3.06
Milwaukee	587,472	2,079,604	8,525	1,627	863	233	2.8	2.79
Oshkosh	39,089	93,904	510	279	48	17	7.1	5.01
Racine	67,195	289,426	1,627	360	100	31	5.4	2.88
Sheboygan	40,638	35,370	415	295	48	3	7.3	1.59
Superior	35,136	84,620	728	341	43	27	9.7	3.09
Wausau	27,268	87,428	519	260	29	9	9.5	3.03
Wauwatosa	27,769	58,000	380	116	31	3	4.2	1.59
West Allis	36,364	102,257	649	231	47	25	6.4	1.38
WYOMING								
Cheyenne	22,408	27,983	409	304	16	23	13.6	3.27
HAWAII								
Honolulu	200,158	551,097	1,271	353	150	131	1.8	2.00

1948 FIRE LOSSES, CANADIAN CITIES

ALBERTA								
Calgary	100,044	838,932	855	....	....	96	....	3.94
Edmonton	113,116	661,920	984	833	44	....	7.4	4.08
BRITISH COLUMBIA								
Burnaby	35,000	172,590	396	263	24	12	7.5	3.37
New Westminster	24,000	119,098	441	243	26	18	10.1	2.72
Saanich	25,000	22,000a	202	103	11	....	4.1	1.31
Vancouver	311,800	1,796,868b	4,501	2,550	126	135	8.2	4.54
Victoria	53,000	203,853	675	568	46	62	10.7	1.81

a. Estimated. b. Subject to change. c. Insured loses only.

City	Population	Total Loss 1948	No. Alarms 1948	No. Bldg. Fires 1948	No. Auto Fires 1948	No. Malicious False Alarms 1948	Bldg. Fires Per 1000 Population	5-Year Average Loss per Person
MANITOBA								
St. Boniface	21,613	26,640	340	149	18	28	6.9	1.21 (1)
Winnipeg	229,045	1,090,379	2,661	1,032	102	247	4.5	3.27
NEW BRUNSWICK								
Moncton	22,763	166,202	425	264	19	20	11.6	5.92
St. John	51,741	464,970	1,159	875	21	70	16.9	4.98
NOVA SCOTIA								
Glace Bay	25,147	57,321	105	73	9	....	2.9	2.49
Halifax	106,742	308,739	1,244	1,006	53	110	9.4	4.18
Sydney	28,305	305,231	350	129	6	....	4.6	4.78
ONTARIO								
Brantford	34,848	151,829	550	215	57	6	6.2	2.42
East York Twp.	43,399	95,295	320	92	31	8	2.1	1.04
Fort William	29,103	113,684	428	238	15	10	8.2	4.37
Guelph	23,273	43,353	284	27	7	....	1.2	6.44
Hamilton	175,364	1,248,809	1,900	632	178	161	3.6	5.98
Kingston	33,296	107,715	495	303	45	37	9.1	7.08
Kitchener	36,797	225,327	326	246	14	24	6.7	2.16
London	81,158	171,316	801	292	52	29	3.6	1.59
North York Twp.	26,000	111,147	474	126	30	12	4.8	4.70
Oshawa	26,856	43,816	386	217	41	13	8.1	2.41
Ottawa	195,327	784,532	1,744	1,266	156	152	6.5	3.75
Peterboro	32,379	265,586	723	477	41	36	14.7	8.61
Port Arthur	25,100	87,406	495	132	19	12	5.3	7.77
St. Catharines	24,559	96,229	533	233	30	12	6.8	2.36
Sarnia	20,082	93,953	196	32	20	16	1.6	2.83
Sault Ste. Marie	28,813	138,852	362	69	22	34	2.4	2.26
Scarboro Twp.	24,142	96,398	468	79	26	43	3.3	2.85
Sudbury	35,812	75,831	434	337	10	....	9.4	3.64
Timmins	24,070	76,521	487	345	16	20	14.3	9.12
Toronto	745,626	3,487,881	6,131	3,662	608	577	4.9	3.79
Windsor	108,567	531,053	....	....	....	....	....	3.19
York Twp.	80,348	112,473	506	190	33	16	2.4	0.93
QUEBEC								
Chicoutimi	20,103	49,966	247	211	....	15	10.5	8.74
Hull	36,909	264,175b	832	333	15	56	9.0	3.23
Jonquiere	21,500	41,002	378	29	3	37	1.3	7.32 (4)
Lachine	27,104	70,968	355	69	9	58	2.5	9.28
Montreal	983,000	6,339,863	10,118	3,354	537	2,375	3.4	4.57
Outremont	31,400	145,550	282	52	20	21	1.7	2.10
Quebec	176,386	822,430a	2,931	1,660	89	485	9.4	4.27
Shawinigan Falls	23,868	23,007	259	193	7	11	8.1	3.48
Sherbrooke	38,942	72,287	738	115	46	37	3.0	2.31
Three Rivers	46,000	83,207	483	329	24	20	7.2	4.82
Verdun	74,080	332,256	761	419	36	130	5.7	2.03
Westmount	25,328	45,806	299	62	21	31	2.4	2.01
SASKATCHEWAN								
Moose Jaw	23,069	44,008	343	147	21	26	6.4	1.98
Regina	60,246	104,604	640	326	29	60	5.4	1.97
Saskatoon	46,028	79,145	635	425	21	65	9.2	2.72

a. Estimated. b. Subject to change. (1) One year only. (4) Four year only.

United Kingdom Fire Experience Statistics

Perhaps the most comprehensive fire experience statistics presently available are prepared in the United Kingdom. The war-time inspired development of the National Fire Service in England and Wales, Scotland and Northern Ireland permitted the establishment of a uniform fire reporting service which is unparalleled on a national basis as far as is known to this Association. This article reviews the United Kingdom fire experience for the year 1947.

Organizations Responsible

It is fairly well known on both sides of the Atlantic that the air raids on the United Kingdom during World War II led to the establishment of a National Fire Service (Fire Services Act, 1941). This organization was not actually secured before the Battle of Britain had been won in the air (September 1940), but a strong fire service arm was nevertheless provided, administered by a Fire Service Department organized in the Home Office. On April 1, 1948, however, the duties which had been carried out during the war by the National Fire Service were returned to local fire brigades under terms set forth in the Fire Services Act of 1947. In August 1948 there were 134 such fire brigades in England and Wales. In making this change back to local administration of fire services, however, the Secretary of State retained powers to make regulations covering, among other matters, the conditions of service and pensions of brigade members, standards of equipment, training and efficiency. Particularly important is that the standardized system for reports of fires (which was first developed in 1944 and upon which the United Kingdom fire statistics are based) is being continued under the present decentralized fire brigade plan.

During the war, research was carried out on a wide range of fire problems by a division of the Research and Experiments Department of the Ministry of Home Security. After the war, the Ministry of Home Security was dissolved and the responsibility for fire research was placed in the hands of the Department of Scientific and Industrial Research (DSIR). This Department and the Fire Offices' Committee (an association of the tariff fire insurance companies in the United Kingdom) set up a Joint Fire Research Organization to undertake the investigation of the initiation, growth, and suppression of fires, studies of the structural aspects of fires in buildings, analysis of special fire hazards and the evaluation of fire fighting equipment and technique. On January 1, 1947, Mr. S. H. Clarke was appointed Director of this new organization.

It is under the purview of this Joint Fire Research Organization that the "Statistical Analysis of National Fire Service Occurrence Reports for 1947," reviewed in this article, was prepared. This study, identified as "Fire Statistics Note No. 61, September 1948," analyzes 73,553 fires attended by the National Fire Service during 1947. Of these 73,553 fires, 37,278 occurred in buildings and the balance, 36,275, occurred outside of buildings.

Fire Alarm Transmission

Seventy-five per cent of the 73,553 alarms summoning National Fire Service

personnel to fires in the United Kingdom during 1947 were transmitted by public telephone. This is similar to U. S. and Canadian experience although records in the latter two countries do not permit such a precise accounting because of the lack of uniform nation-wide fire reporting service. The following condensed table presents the principal statistics on alarm transmission mediums:

Table No. 1 — Method of Calling N.F.S. to Fires

Method	No. of Fires	Per Cent
Exchange telephone.....	55,108	74.9
Special Fire Service means*	9,818	13.4
Running call.....	5,858	8.0
Late call (N.F.S. call after fire extinguished)	2,228	3.0
Other and undefined means	541	0.7
Total.....	73,553	100.0

*Includes Police Calls, Street Fire and Police Boxes, Private Fire Telephones, and Automatic Fire Alarms.

It is interesting to note that in the records on the 248 largest building fires of 1948 in the United States and Canada (reported in the January 1949 QUARTERLY) about 62% of the fires were first reported by telephone. If such alarm transmission information were available on the thousands of smaller fires, the percentage of telephone alarms would doubtless parallel United Kingdom experience.

English Occupancy Fire Record

There is naturally some difference in the occupancy classifications used by the NFPA in reporting fires occurring in the United States and Canada and those employed by the Joint Fire Research Organization in England. Table No. 2 groups the United Kingdom statistics in the general categories understandable to the bulk of our QUARTERLY readers.

Since detailed records are not available of comparative U. S. fire loss distribution by occupancy, it is difficult to draw any exact comparisons. However, based on NFPA estimates of building fires for the year 1947 (see October 1948 QUARTERLY, page 109), it might be observed that the relative fire experience frequency by occupancy classes in the U. S. shows higher percentages on farms (by 4.6%), in habitational properties (by 3.5%), in garages (by 1.7%), in warehouses (by 1.4%) and in mercantile stores (by 0.6%). United Kingdom frequency rates, on the other hand, are higher in manufacturing plants (by 7.7%), in schools and hospitals (each by 0.7%), in places of public assembly (by 0.5%) and in churches (by 0.2%). It is important to note that the total number of fires estimated in buildings in the United States is about fourteen times (538,000) the number recorded for the same year in the United Kingdom (37,278) fires and the frequency rates given above refer only to the relative distribution of fires by property types. As regards outdoor fires, U. S. forest fires are, quite naturally, much more prevalent than those experienced in the United Kingdom. NFPA estimates show that 18.2% of U. S outdoor fires are forest losses and this compares with only 2.8% in the U. K. As regards motor vehicle fires, experience in the United States is higher by 6.7%, but this undoubtedly can be explained principally by the much greater number of automobiles in service, and the unrestricted fuel supplies available in North America.

Supposed Fire Causes

The statistics on fire causes presented in the study show some interesting contrasts between fire experience in the United Kingdom and the United States and other striking similarities. Note in Table No. 3 that the United Kingdom has greater fire frequency rates for fires caused by open flames and sparks (principally influenced by their open fireplace grates), from gas

Table No. 2 — Principal Occupancies Sustaining Fires

Occupancies	No. of Fires	Per Cent	No. of Fires	Per Cent
Building Fires				
Habitational properties			20,522	27.9
Private residences or flats	18,216	24.8		
Hotels, clubs, restaurants, pubs, etc.	2,306	3.1		
Manufacturing properties			5,028	6.8
Metalworkers	1,449	2.0		
Building materials	582	0.8		
Woodworkers	559	0.8		
Textile plants (excluding clothing factories)	466	0.6		
Food products	472	0.6		
Chemical, dye, explosive, paint and oil plants	347	0.5		
Clothing and footwear	305	0.4		
All other	848	1.1		
Mercantile properties (retail and wholesale)			3,220	4.4
Farm buildings			1,660	2.3
Garages			1,271	1.7
Offices and government buildings			505	0.7
Navy, Army and Air Force establishments			485	0.7
Places of public assembly			487	0.7
Cinemas and theatres	204	0.3		
Other places of entertainment	283	0.4		
Schools			409	0.6
Hospitals, convalescent homes, etc.			326	0.4
Other public properties			300	0.4
Churches			256	0.3
Warehouses			107	0.1
Other buildings (type known)			2,603	3.5
Undefined			99	0.1
Other Than Building Fires				
Agricultural and forestry			23,029	31.3
Grass and heath	14,633	19.9		
Crops and stacks	2,571	3.5		
Railway embankments	2,239	3.0		
Woods, forests, etc.	1,011	1.4		
Other	2,575	3.5		
Outdoor storage			5,640	7.7
Refuse	3,737	5.1		
Cotton, metal, packing materials, rubber, etc.	722	1.0		
Timber	643	0.9		
Chemicals, explosives, ammunition, oils, etc.	287	0.4		
Coal and coke	251	0.3		
Transportation			5,269	7.2
Automobiles (oil, petrol)	4,022	5.5		
Watercraft	529	0.7		
Railroad rolling stock	428	0.6		
Automobiles (electric and other)	235	0.3		
Aircraft	55	0.1		
Other outdoor structures			2,337	3.3
Total of all fires attended			73,553	100.0

appliances (burners, cookers, heaters), from electricity and electrical appliances, from children playing with matches and tapers, from blow torches and welding equipment, and from hot ashes than is experienced in the United States (this refers only to the percentage of fires, not to number of fires). Contrarywise, U. S. fire frequency statistics show more fires caused by furnaces, smoking and matches, lightning, spontaneous ignition, and arson. These all seem to be logical points of departure when the construction, habits, and climates of the two countries are taken into consideration. (For sparks on roof, flammable liquids and exposure hazards found in the U. S. column and for fish frying ranges and slow combustion stoves in the U. K. column, comparative figures are not available.)

Despite the above differences, the fire problem in both countries is essentially the same—the control of friendly fires and the prevention of hostile fires. While English homes are heated more by fireplace grates and space heaters than by furnaces, while Americans smoke more cigarettes, while thunderstorms occur more frequently in the southern part of the United States than in the British Isles, control over these fire causes is undertaken in the same way on both sides of the Atlantic.

Relation of Cause to Occupancy

One of the most useful fire prevention tools produced by the fire experience anal-

Table No. 3 — Supposed Building Fire Causes

(Shown in Percentage of Fire Frequencies)

Fire Causes	United Kingdom	United States*
Open lights, sparks and flames (includes fireplace grates, candles, locomotive sparks, but excludes chimney sparks)	22.5%	4.7%
Electricity or electrical appliances (improper installation, use, or maintenance and defective equipment)	16.9%*	12.8%
Smoking, matches	13.2%	16.2%
Children playing with matches or tapers	6.4%	3.9%
Gas appliances (burners, cookers, heaters)	4.8%	0.8%
Oil lamps, oil stoves, etc.	2.2%	4.6%
Blow torches, welding equipment	3.0%	0.8%*
Chimneys or flues	2.6%**	5.6%
Sparks on roof	—	5.0%‡
Hot ashes	2.6%	1.2%
Rubbish burning	1.6%†	3.7%
Friction heat or sparks	0.9%	0.3%
Spontaneous ignition	0.8%	1.5%
Furnaces	0.4%	8.3%
Incendiary or suspicious	0.4%	0.9%
Lightning	0.2%	5.0%
Unknown	7.5%	9.4%
Fish frying ranges (all fuels)	1.5%	—
Slow combustion stoves (coal or coke fired)	3.3%	—
Flammable liquids	—	3.7%
Exposure	—	3.4%
Miscellaneous	9.2%	8.2%
Total	100.0%	100.0%

*U. K. percentages on electrical appliances include electric welding; U. S. experience listed under "Blow torches, welding equipment."

**U. K. statistics include only those chimney fires which extended to structure.

‡U. S. experience influenced by wood shingle roofs.

†Rubbish burning in U. K. includes only rubbish fires within the building, U. S. includes those exposing buildings, originating outdoors.

ysis made by the Joint Fire Research Organization of the United Kingdom is a breakdown of fire causes in relation to the occupancies in which the fire started. We can, accordingly, find in what occupancies smoking, for instance, produces the greatest fire hazard. The principal building fires attributed to smoking, in order of frequency, during 1947 in the United Kingdom and the relative severity of the smoking hazard, as compared to other known fire causes, in various occupancies are established in Table No. 4. This table shows that more smoking fires occur in dwellings than in any other single occupancy, but that smoking is the cause of only 8.1% of all the dwelling fires where the cause was established. Of all fires of known cause, 35.6% of those occurring in places of public assembly were occasioned by smoking, although such fires constituted only 3.5% of all the smoking fires recorded.

Table No. 4 — Fires Attributed to Smoking and the Relative Severity of the Smoking Hazard by Occupancies

Type of Occupancy	Percentage of the Total No. of Fires Due to Smoking in Principal Occupancies	Percentage of Fires Due to Smoking Compared with Other Known Causes
Private residences and flats	32.8	8.1
Mercantile stores	11.0	18.1
Clubs, hotels, restaurants and taverns (pubs)	7.1	14.0
Automobiles, railroad rolling stock, watercraft, aircraft	5.6	16.4
Farm buildings	5.0	15.8
Metalworking plants	4.4	14.7
Educational institutions, hospitals, churches	3.9	14.4
Places of public assembly	3.5	35.7
Building material plants	2.9	23.5
Offices	2.8	25.6
Woodworking plants	2.7	24.1
Warehouses	2.3	24.4
Other occupancies	16.0	...
Total (1st column)	100.0	

The development of such statistics gives basic data useful in the conduct of any campaign for fire waste reduction. Educational methods striking at the roots of fire causes directed where they apply most forcefully will obviously carry more weight than generalized propaganda.

Fire Extinguishment

Among the most useful statistics in fire service are data on how fires are extinguished. Through such information it is possible to plan more adequately the facilities required to control fires when they occur. In the studies made on 1947 fire experience in the United Kingdom, the following excerpts are particularly pertinent:

Unfortunately, there are no statistics available which might be used to compare these extinguishment methods with North American experience. They stand well enough alone to prove the often reiterated point that adequacy of fire protection must be a combination of public and private facilities and that fires discovered in their incipiency can be controlled by first aid fire appliances or booster tank hose lines. Approximately 60% of the 36,842 fires where method was known were extinguished by booster tank lines, extinguishers, buckets, hose reels or garden hose, and another 12% were extinguished by removal of burning materials, smothering, burning

out of the combustibles, beating, applying sand or dirt or a combination of the aforementioned means. This indicates that only about one-quarter of the fires required the major services of public fire service attendance or automatic sprinkler protection. When needed, this service is usually needed very badly indeed, and for these comparatively few serious fires their provision is amply justified.

English Automatic Sprinkler Experience — 1947

The information in Table No. 5 shows data on sprinklers only when they *completely controlled* the fire, in 36 cases. Further tabulations on sprinkler performance are given in Tables Nos. 6 and 7. Referring to Table 6, sprinklers *held the fire in check* in 113 other cases. The 70 cases in Table No. 6, where insufficient heat was generated to operate sprinklers, would, by NFPA practice, be listed as fires where the sprinklers were "not a factor." At least 84% of these fires in sprinklered properties would be rated "satisfactory" following the same system of rating as used by the NFPA. This one year sample of fires is really too small in number to conclude that United Kingdom sprinkler installa-

Table No. 6 — Behavior of Automatic Sprinkler Systems

Installed but did not operate because:		89
Insufficient heat generated by fire	70	
Installation undergoing repairs	11	
Explosion damaged system	2	
Incorrect sprinkler "head" installed	2	
Frozen system	1	
System drained to prevent freezing	1	
Fire above sprinklers	1	
Unknown cause	1	
Operated but did not control fire because:		28
Fire started or spread above sprinklers	7	
Fire not in range of sprinklers	5	
Fire spread rapidly due to nature of materials involved	3	
Water supply turned off	3	
Obstruction deflected water from fire	2	
Insufficient water supply	1	
Incomplete protection	1	
Failed to penetrate cotton bales	1	
Other causes	3	
Unknown causes	2	
Controlled but did not extinguish fire		113
Extinguished fire (see Table 5)		36
No. of calls to fires where sprinklers installed		266

Table No. 5 — Methods of Extinguishment — Building Fires*

Line No.	Method	No. of Fires	Per Cent
1	Hose lines from booster tanks	9,229	24.8
2	Hose lines from pumps and hydrants (may also have used other methods listed)	7,281	19.5
3	Hand fire extinguisher (exclusive of other methods—includes stirrup or hand water pumps as well as chemical extinguishers)	7,215	19.3
4	Water from buckets (exclusive of other methods)	5,537	14.8
5	Removal of burning material from building or turning off gas supply from fire (exclusive of other methods)	3,239	8.7
6	Hose lines (using more water than that in truck tank but not hydrant supplies)	2,389	6.4
7	Smothering (exclusive of other methods)	612	1.6
8	Combination of beating and smothering, and the use of extinguishers or water buckets or sand and earth	489	1.3
9	Burned out by itself	360	1.0
10	Beating (exclusive of other methods)	174	0.5
11	Sand, earth, etc. (exclusive of other methods)	132	0.4
12	Water from garden hose, etc.	75	0.2
13	Use of inside hose reels (standpipes)	74	0.2
14	Automatic sprinkler systems	36	0.1
15	Other and undefined methods	436	1.2
		37,278	100.0

*Methods indicated on lines 1, 6, 13 include occurrences in which methods on lines 3, 4, 7, 8, 10, 11, 12 and 15 may also have been used.

Table No. 7 — Number of Sprinklers Operating
(With NFPA Comparative Figures)

No. of Operating Heads	U. K. No. of Cases	U. K. Percentages	NFPA Percentage*
No heads actuated	89	..	..
1 to 5 heads operated	131	74.0	72.8%
6 to 10 heads operated	19	10.7	10.7
11 to 20 heads operated	12	6.8	7.0
More than 20 heads operated	12	6.8	7.5
Unknown number	3	1.7	2.0
Total	266	100.0	100.0

*See NFPA Handbook of Fire Protection (10th Edition), page 909.

tions show an overall lower percentage of "satisfactory" performance than in the United States, where the NFPA figures an efficiency of 95.9% (see QUARTERLY, April, 1945).

The number of responses of N.F.S. equipment to properties protected by automatic sprinklers does not include those fires where no alarm or "late call" was given.

Table 8 — Fire Casualties in the United Kingdom — 1947

Fatal casualties		498
National Fire Service personnel	3	
Others	495	
Non-fatal casualties		3,890
National Fire Service personnel	1,495	
Others	2,395	
Total casualties		4,388

Table 9 — Nature of Injuries in Fire Casualties

Fatal casualties		498
Burns and scalds	314	
Overcome by gas or smoke	52	
Other and undefined injuries	132	
Non-fatal casualties		3,890
Burns and scalds	1,961	
Bruises, cuts, abrasions	979	
Dislocations, sprains, fractures	176	
Overcome by gas or smoke	92	
More than one of above four	119	
Shock	189	
Other and undefined injuries	374	
Total casualties		4,388

Fire Casualties

Tables 8 and 9 have been extracted from the analysis made by the Joint Fire Research Organization's report on fire casualties in the United Kingdom in 1947. There are no comparable statistics available in the United States.

The NFPA wishes to express its appreciation to the Joint Fire Research Organization for providing the information on which this article is based. We feel that it is a most significant milestone in fire record statistics, and we wish to compliment the Organization on its constructive activity in this field. Particular thanks are due to Mr. S. H. Clarke and to Mr. J. Wallace of the Joint Fire Research Organization for their active cooperation in preparing this article for the QUARTERLY.

Gas Generating Plant Explosion, Chicago

One employee of the Peoples Gas Light and Coke Co. was killed and 13 injured in an explosion that demolished the blower house and severely damaged the adjoining water gas generating building, January 28. Approximately 50 employees in the Commonwealth Edison Co.'s 3- to 14-story fire-resistive office and warehouse building 180 feet away were also injured when pressure waves blew in windows and damaged a number of internal partitions on the exposed side. Property damage at the gas plant may reach $350,000, with an additional $25,000 damage to the exposures. The equipment involved in this explosion was stand-by apparatus undergoing its annual test. The explosion offers further proof that automatic features of mechanical equipment operated at infrequent intervals are difficult to maintain, and stand-by equipment such as this should therefore be operated more frequently.

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An explosion 180 feet away broke windows and interior partitions on the exposed side of this fire-resistive building. Many occupants were injured by flying glass.

Water gas, a mixture of carbon monoxide and hydrogen, is made by passing steam into a bed of incandescent coke kept above 1832°F. At coke temperatures below 1832°F. an undesirable mixture of carbon dioxide and hydrogen is formed. Since the water gas reaction absorbs heat from the coke, it is therefore necessary to reheat the coke to its normally high temperature at frequent intervals. This is accomplished by increasing its combustion rate with a blast of air. In general practice (varied slightly in different plants) water gas generation lasts three minutes, purging one minute, and air blast two minutes, after which the cycle is repeated. The steps are controlled automatically by hydraulic valves.

The generator building is a high 2-story without basement, fire-resistive building of 5292 sq. ft. ground floor area. Floors are steel plate or iron grille and connected by an open iron stairway. Of the four generators, one was in operation, one was shut down but had burning coke in the bottom, and the other two were shut down. The adjoining 1-story brick, wood-joisted blower house (area 1575 sq. ft.) was separated by a 16-inch fire wall pierced by air blast tubes leading to the generators. Neither building had adequate provision for explosion venting.

Shortly after 1:00 P.M. a stoker on the ground floor of the generator building noticed water gas leaking at an air blast tube flange. The gas generating part of the cycle was in progress at that particular time, during which automatically controlled valves should have prevented

Based upon reports submitted by the Chicago Fire Department, Cook County Inspection Bureau and the National Inspection Company.

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Failure of an automatically controlled valve on stand-by equipment to close properly allowed gas to escape and explode. Rubble in the foreground is all that remains of the blower house and the fire wall that separated it from the generating building. Neither building had adequate provision for explosion venting.

water gas from backing into the air blast tubes. Before operators on the floor above could shut down the machine an explosion occurred in the adjoining blower house and blew back through the blast tubes to the generator house. The fire department responding to a still alarm at 1:17 P.M. found the blower house demolished, the intervening fire wall destroyed and fire caused by ignition of flammable oil released from broken hydraulic lines burning in all parts of the generator building. Pressure waves had caused extensive damage to windows in other buildings in the plant and in neighboring property. With the help of equipment summoned by two additional alarms, firemen had the fire out at 2:21 P.M.

Investigation has traced this explosion to mechanical failure of the generator blast valve mechanism. Failure of this valve to close automatically following the air blast period permitted gas to back through the air blast tube to the blower house during the succeeding gas generating period. Here, the gas mixed with sufficient air to form an explosive mixture and ignited.

Charleston, W. Va., Mercantile Fire

Charleston, West Virginia firemen were summoned to the 3-story brick, wood-joisted F. W. Woolworth & Co. store at 3:55 A.M., March 4. An hour later, they were still trying to locate the source of a large volume of smoke on the first floor and basement when without warning a portion of the floor collapsed. Several firemen in the rear of the first floor and in the basement were trapped by falling debris. Seven were killed and of those who extricated themselves or were rescued, 12 required hospitalization. Loss, including damage in adjoining buildings, is estimated at $400,000. The fire generated a large amount of smoke and heat but very little flame. In the absence of any large concealed space in which it might smolder undetected, how the fire could have burned sufficiently to cause floor collapse before being located remains a mystery.

Based upon reports submitted by the Fire Marshal of West Virginia, and the West Virginia Inspection Bureau.

Woolworth Building

F. W. Woolworth & Co. occupied an unsprinklered 3-story brick, mixed semi-mill and ordinary wood-joisted building in the middle of a business block in downtown Charleston. Undivided floors of 4600 sq. ft. area were connected by an enclosed brick elevator shaft, a partly

A. H. Pruett, Jr.

This fire illustrates two means by which flames can extend to adjoining structures. Fire in the 3-story building of origin (heavy stream entering third floor window) extended to the 3-story building at right through continuous joist sockets in the party wall. The 7-story fire-resistive building at left was in danger of ignition because of plain glass windows on the upper floors.

open stairway from the basement to first floor, a large open stairway from first to second and a nonstandard enclosed stairway from the second to the third. The building had first aid extinguishers but no watchman protection. The basement where the fire originated was used principally for stock storage. It was not ceiled except for a small men's locker room 15 feet from the point of floor collapse. Heating units, the refrigerator compressor and the main electric service panel were located in a well-cut-off fire-resistive furnace room with concrete floor and roof.

At 3:30 A.M., police in a cruiser smelled smoke at Woolworth's but saw no evidence of fire. Twenty-five minutes later the same officers again passed the building. This time smoke was visible in display windows and the alarm was given. Two engines and a ladder arrived at 4:05 A.M. When search of the first floor failed to reveal any evidence of fire the men proceeded to the basement. A small amount of fire on some cartons near the ceiling line was quickly extinguished with a booster line and firemen who were under the impression that the fire was out prepared to return to quarters. However, when the smoke and heat persisted, additional men equipped with masks entered the basement and continued the search for the source. Intense heat was noticed overhead and comparatively cold air near the floor. When it became increasingly difficult to work, a second alarm was struck that brought all available apparatus and manpower, including the off shift. With these reinforcements, additional lines were laid into the first floor and holes were cut in the flooring in an attempt to reach the fire with cellar nozzles. Fire was still not visible and it was not until an hour after the first alarm that a small amount of flame appeared on the first floor. This was promptly extinguished, but at that moment the rear section of the first floor collapsed and trapped the firemen. Intense heat and flames immediately developed, and in the ensuing period while firemen tried desperately to rescue their comrades the fire gained considerable headway and spread up open stairways to the second and third floors. At 7:30 A.M., the entire rear half of Woolworth's was in flames from basement to roof and exposures on either side were in imminent danger of taking fire.

Additional lines were laid as soon as possible by the seriously depleted manpower and by 9:00 A.M., 18 were in operation at Woolworth's and adjoining exposures. Frontal attack at Woolworth's building using ladder pipes at the third floor level, deluge sets through second floor windows and hand lines at the ground floor was effective and prevented fire damage to the forward half of that store. At the rear, other streams were used to confine the flames and to cool the area where the men were trapped. By noon the fire was under control and recovery of bodies could be started.

Kresge Building

Fire threatened buildings adjoining either side of Woolworth's and, in fact, did considerable damage to the roof and attic of the adjoining 3-story brick, wood-joisted building (floor areas 9000 sq. ft.) occupied by S. S. Kresge Co. This building was protected by a single source wet pipe sprinkler system. The only unprotected section was the rear 30 feet of a concealed space beneath the sloping roof which could not be sprinklered since the ceiling and roof joists were separated by less than six inches. This proved to be a serious weakness as was also the construc-

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Firemen had spent an hour trying to reach the source of heat and smoke beneath the floor of the 3-story brick, wood-joisted store. Seven men were killed and 12 hospitalized when the fire-weakened floor gave way without warning.

tion of the party wall separating Kresge's from Woolworth's. Floor joists from both buildings rested in continuous sockets in the 16-12-12-inch wall (8 inches in attic). Although in some instances four inches of loose masonry had been inserted between joist ends of the adjoining buildings, these sockets were the means of fire spread to the Kresge building. All vertical openings in this structure were enclosed, with approved fire doors at floor levels, and private protection besides the sprinklers consisted of first aid extinguishers and hourly watchman tours during the night.

At 7:55 A.M., the sprinkler alarm started to ring and 30 minutes later fire was breaking from the roof of this structure also. Flames which had spread through joist openings to the unsprinklered section of the concealed roof space burned out roof supports and collapsed the rear 30 feet of roof. However, forward spread through the concealed space was prevented by the operation of 21 sprinklers and with the help of hose streams operated from the front part, fire was confined to the rear 30 ft. of roof. Fire also passed through fire wall sockets at the floor level of the third story, but was quickly extinguished with first aid extinguishers.

Bank Building

The unsprinklered, 7-story Charleston National Bank Building, notwithstanding its fire-resistive construction, was seriously exposed on the other side of Woolworth's. Early in the fire, flames and heat from the roof of the 3-story Woolworth building threatened to enter unprotected plain-glass windows on upper floors and was only prevented from doing so by firemen who had been stationed with hose lines on upper floors. Fire damage to this building was confined to broken windows and scorched wooden window frames.

Cause

Although the cause of this fire has not been established, there is a possibility that it may have originated from defective electrical equipment or wiring. This theory is based on the fact that the main switch controlling first floor lights was located in the open on the basement ceiling near the point of floor collapse. All first floor lights were out of service when the first fire companies arrived, although the elevators and lights on other floors were still in service. The latter were controlled by equipment in the cut-off fire-resistive furnace room.

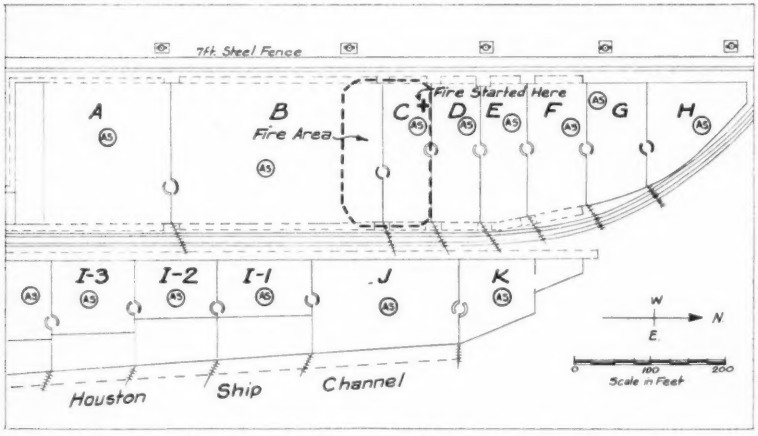
Cotton Warehouse Fire, Houston

The recent cotton warehouse fire at Pinedale, California (see page 302), is not an isolated example of the disastrous results that follow when management fails to provide competent emergency protection during periods of sprinkler shut down. On January 30, 1949, at Houston, Texas, the Ship Channel Compress Co., Inc., lost a warehouse and 1740 bales of cotton because the property had been left in charge of an incompetent watchman while sprinklers were temporarily shut off. The Houston and Pinedale fires emphasize the importance of keeping personnel who are thoroughly familiar with sprinkler equipment on the premises 24 hrs. daily when it is necessary to shut off the system for any reason.

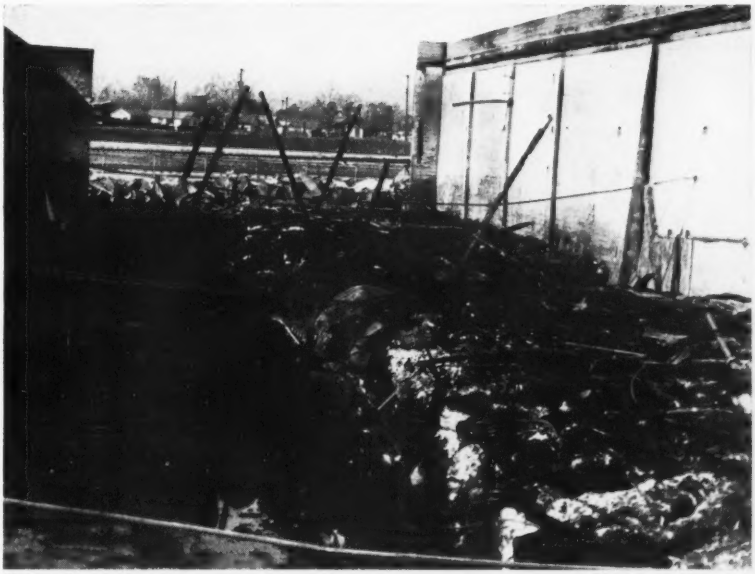
Warehouse C (see diagram) was 66 ft. by 190 ft., 1 story high, and without basement or concealed space. East and west walls were open (true of all warehouses A through F). A 12-inch reinforced concrete fire wall with 3½ foot parapet and with T's extending 5 feet south and 14½ feet north separated C and D. A similar wall with T's extending 9 feet each way separated C and B. A single opening in each wall was protected on each side by fire doors equipped with heat actuated releases. Five-foot-high monitors with plain glass sides extended the full width of the metal-clad, wood-frame roof. Construction of warehouse B was similar to C with the exception of the roof, which was saw-tooth with plain glass in vertical sides. Nine-foot wooden platforms with canopies extended the length of both sides of the warehouses except at the T's where the canopy is removed and the platform is concrete. Cotton bales were stored in C and B on end, one bale high, and with one cross and one center aisle.

All warehouses were protected by two-score wet pipe sprinkler systems; standpipes with hose were provided in A and B, and hose connected to sprinkler piping

Based on reports by the Fire Prevention and Engineering Bureau of Texas, and the Houston Fire Department.



Houston, Texas Cotton Warehouse Fire, January 30.



Houston Fire Department.

The wet pipe sprinkler system in this open-ended cotton warehouse was drained to prevent freezing. The watchman was unaware of this condition and had no idea how to turn on the water. Firemen were unable to use several nearby yard hydrants since a 7-foot-high steel fence (visible in the background) prevented access.

was available in C through H; extinguishers and casks with pails were well distributed; sprinklers were central-station supervised as were the half-hourly watchman tours. Weaknesses in this apparently ironclad protection, however, became readily recognizable as the fire progressed. Sprinkler equipment which had been shut off at 8:56 A.M. January 29 due to extreme cold (26° to 22° F) and was still shut off at the time of the fire. The two hose connections in warehouse C (fire origin) were useless since they relied on sprinkler piping for water. Casks of water had begun to freeze, making use of buckets difficult. A 7-foot-high steel fence without gates prevented fire department access to yard hydrants to the west of warehouses A through H. The incompetency of the watchman, a 65-year-old man with one hand, was evidenced by the fact that he was unaware that sprinklers were shut off, his admission that he would not have known how to turn them on in any case, his failure to close all fire doors, and his failure to use the nearest fire alarm.

Attention is also called to the wet pipe sprinkler systems in the open-ended buildings. Wet systems were permitted in Texas in 1922 when these were installed, but present day rules require dry systems in open buildings. Had the systems at the Channel Compress Co. been converted to dry pipe there would have been no need to remove protection during the cold period.

When first discovered by the watchman at 3:30 A.M. in warehouse C, fire was confined to three bales against the north wall. He managed to get two pails of water from the freezing cask, and then left the building and crossed railroad tracks to full a fire alarm box on warehouse J, pulled an-

other box in D, shut one fire door between C and D, instructed another watchman to phone the alarm, and finally pulled a box in B. The watchman was then joined by a railroad brakeman and the two tried to reach hose in C (connected to the closed sprinkler system) but were driven back by the heat.

Firemen arrived at the main gate at 3:42 A.M. and after a 5-minute search located the fire in warehouse C, which by now was burning fiercely at the ceiling. Additional alarms were transmitted and a hose was stretched from the nearest accessible hydrant, south of warehouse A and 700 feet from the fire. A 7-foot-high steel fence prevented use of several nearer hydrants. The roof of C was in flames and a 16 mph northeast wind was carrying heat and embers to the roof of B by the time the first line was in operation. Plain glass windows in the vertical side of the first bay of the sawtooth roof of B, 22 feet from the fire wall, broke and allowed embers to drop on cotton inside. The wind also carried flames around the T'd walls into B. Standpipe hose in B were used to wet down cotton, and with the help of streams from a fireboat and from a pumper located at a yard hydrant at a neighboring plant confined fire damage in B to the north 22 feet of the roof and 57 bales. Fire in C burned out of control until midmorning and was not finally extinguished in the bales until several days later.

Preliminary loss estimates place damage to buildings at $50,000 and to burned and wet cotton, $400,000. Total $450,000.

Sprinklers Shut Off — Loss $1,100,000

There are times when automatic sprinklers must be temporarily shut off due to unusual circumstances, but in such cases, extraordinary precautions must be taken.

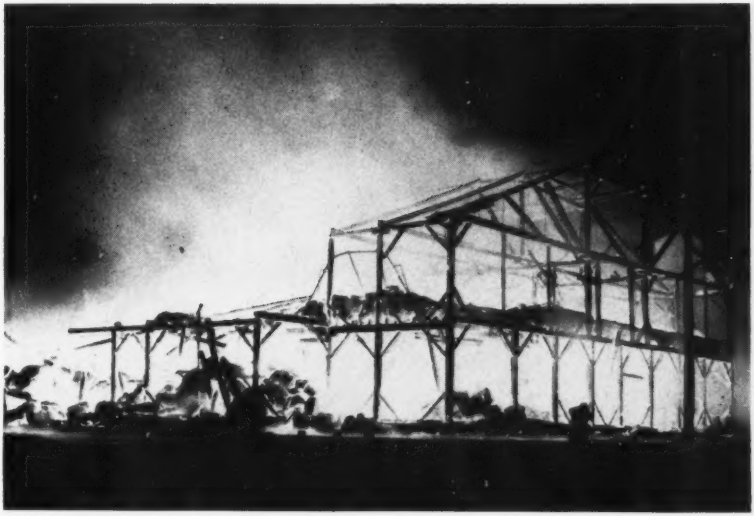
Sprinkler protection had been disconnected to prevent freezing in cotton warehouse No. 7 of the Pinedale Compress and Warehouse Company at Pinedale, California. Fire broke out in the second story during the night of January 23, 1949, and destroyed the warehouse and 6350 bales of cotton because no special precautions were taken during this emergency period.

The two and three-story wood-frame, metal-clad warehouse No. 7 (originally a sawmill) was one of a group of buildings now occupied principally for cotton compressing and storage. Most of the structures, including warehouse No. 7, were completely protected by a two-source supply wet pipe sprinkler system. Water for sprinklers and yard hydrants was distributed in 8- and 10-inch mains supplied by a 1500 gpm automatic electric fire pump, a 2500 gpm manual electric fire pump, and a 100,000-gallon gravity tank elevated 150 feet above grade.

The unusually cold weather that California had experienced since early in the month had been responsible for several sprinkler freeze-ups with leakage. The management of this plant had therefore requested and been granted permission to drain sprinkler equipment temporarily. The system had not been restored prior to the fire.

Watchman protection substandard because of insufficient stations was further aggravated since several watchmen had either quit or been discharged during recent weeks, and replaced by inexperienced

Based upon reports submitted by the Pacific Fire Rating Bureau and the Oregon Division of Forestry Fire Department.



Wide World

The wet pipe sprinkler system in this cotton warehouse had been drained to prevent freezing. No one had informed the watchman that sprinklers were shut off nor instructed him as to the proper steps to take in case of fire,—a costly oversight.

men. On the night of the fire, only one watchman was on duty.

At 10:45 P.M. reflection of fire on the second floor of warehouse No. 7 was seen by this watchman while touring another building (he had entered No. 7 at 10 P.M. and noticed nothing unusual). Following discovery, the watchman drove to the main gate, sounded the plant fire siren, opened the gate and returned to the fire. It was then that he noticed that sprinklers were not operating and on checking sprinkler control valves found them closed. There is no evidence that he opened the valves. The fire which by then had spread through unprotected stair and elevator shafts had reached such proportions that it is doubtful whether sprinklers could have controlled it.

Plant employees arriving at 11 P.M. connected hose lines to hydrants to protect threatened exposures, but were forced to abandon this plan when they were unable to obtain water. It has since been determined that the plant engineer checked the gate valve at the base of the gravity tank and found it open, but apparently no one checked sectional control valves on yard mains, or the automatic fire pump.

At 11:15 P.M., two Forestry Fire Department pumpers equipped with water tanks arrived. These trucks, later augmented by a third pumper and a 2000-gallon tank truck, immediately went into action to save surrounding buildings. An exposure fire was extinguished in warehouse No. 20, 150 ft. away, after burning 7 bales. Another fire in warehouse No. 15, 20 ft. away, burned 157 bales. Firemen using a 2½-inch line from a village hydrant 1200 feet away prevented any damage to seriously exposed warehouse No. 16, 100 ft. from No. 7.

Loss is estimated at $1,100,000, of which approximately $1,000,000 represents damage to cotton.

Fire Commissioner, Saskatchewan

Regina Car House Fire

The well-known hazards of a large area building without automatic sprinklers, of combustible wallboard, of concealed roof spaces, of incomplete fire walls, and of unprotected steel were again illustrated at a cost of $1,117,000 in the Municipal Street Railway Car House, Regina, Saskatchewan on January 23, 1949. The building and its contents of 14 street cars, 11 trolley buses, 9 gasoline buses, and electrical equipment and machinery necessary for the operation of a street railway were destroyed.

The one-story car barn was 279 x 134 feet. Masonry walls were 16 feet high, roof framing was unprotected steel. The most important structural feature was a suspended combustible wall-board ceiling nailed to wood joists. The concealed space between the ceiling and roof extended over the entire building. The effect of the ceiling can be judged from the fact that fire started in the concealed space and burned undetected above the heads of employees for at least an hour. Fire was so advanced when finally observed that minutes later flaming sections of the combustible ceiling started falling on trolleys and buses. A so-called fire wall divided the building into a storage area containing five parallel tracks and a smaller two-track repair section. The wall is of interest because of its substandard construction,—two courses of brick extending to a height of six feet and tile extending from there to the suspended ceiling. The wall did not extend through the concealed roof space. Yet it was apparently thought that the wall was an effective fire barrier since the only two openings were equipped with fire doors.

Based upon reports submitted by the Regina Fire Department and the Office of the Fire Commissioner, Province of Saskatchewan.

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No. 2, Part 2. Membership Directory "Year Book."

No. 3, Part 2. Churches Are Burning.

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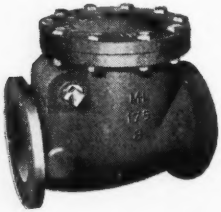

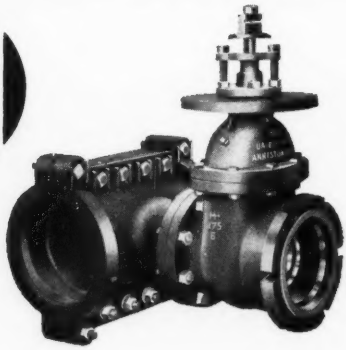

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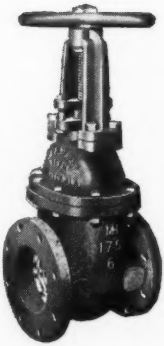
Top, Left: Swing Check valve.

Above: Tapping Sleeve and valve to tap a main under pressure.

Right: Rising Stem Gate Valve, bronze mounted.

Below, Right: Mill Yard Hydrant, Independent Hose Gate Valves.



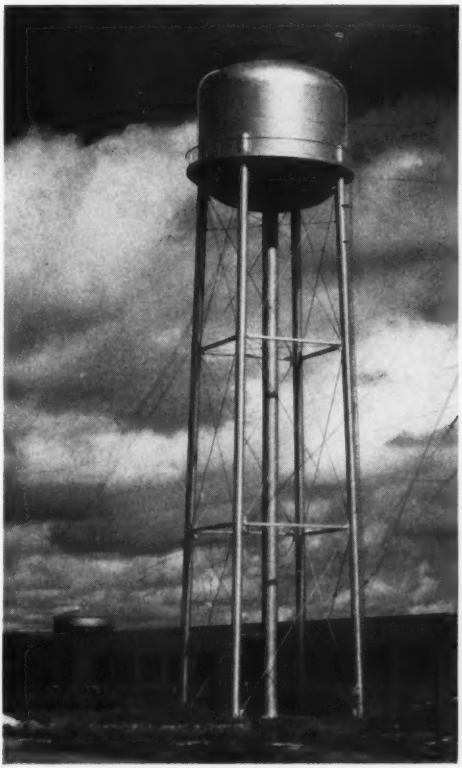
Left: Adjustable Indicator Post.

MECHANICAL JOINTS

In addition to regular hub ends and flanged ends, M&H Valves and Hydrants are now furnished with stuffing-box type Mechanical Joints for use with Standardized Mechanical Joint cast iron pipe.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

PROTECTS NEW PLANT



This 100,000-gal. elevated steel tank maintains gravity water pressure in the automatic sprinkler system at Hibbard, Spencer, Bartlett & Company's new plant at Evanston, Ill.

The new building, which contains 792,000 sq. ft. of floor space, is completely equipped with automatic sprinklers. The primary source of water for the sprinkler system is provided from the city water mains.

Hibbard, Spencer, Bartlett & Co. are wholesale distributors of hardware, tools, cutlery and sporting goods. Their products are distributed throughout the United States and they handle between 15,000 and 25,000 items each day.

All operations of the company, except those items shipped from the factory that makes them, are concentrated at this one plant. A disastrous fire at this plant would interrupt all operations of the company, therefore adequate fire protection is important.

Write our nearest office for quotations on tank installations. State capacity, height to bottom and location.

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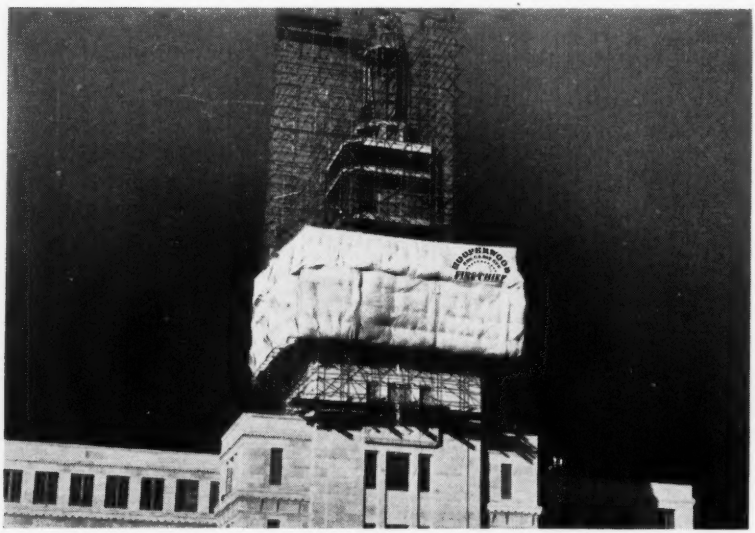

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—THE PRICE OF SECURITY!

WHETHER IT BE NATIONAL OR INDIVIDUAL PERFORMANCE . . . SECURITY IS ACHIEVED ONLY BY THE EVER-ALERT, EVER-CAPABLE AND EVER-DEPENDABLE!

All of these requisites for SECURITY against loss of life and property by fire are provided through the "ETERNAL VIGILANCE" of

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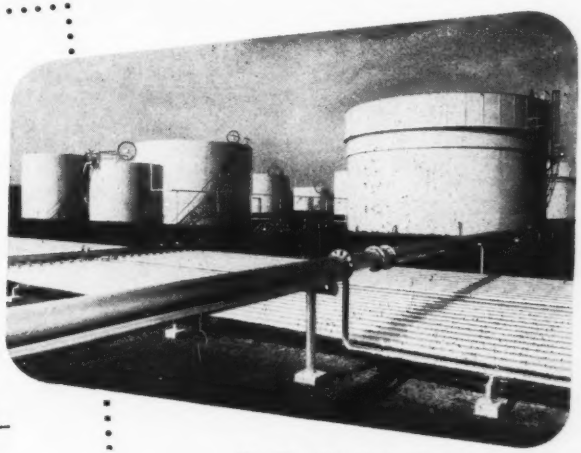

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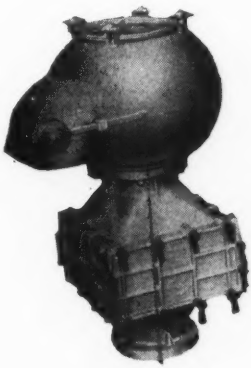

"VAREC" approved CONSERVATION VENT UNIT—FIG. NO. 38A—Consists of Conservation Vent Valve with inside Flame Snuffer and Entrainment Separator Flame Arrester.

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IN SERVICE...
APPROVED
BY SAFETY AUTHORITIES

The measure of a safety device can best be made by the job it has done when it was needed. Safety authorities can test and make known what such devices will do under preconceived conditions but field results are as important as laboratory tests.

The field results with all VAREC Equipment have been outstanding. This speaks equally well for the quality of the equipment and the competence of the engineers who selected it. Its quality stems from an organization who for over twenty years have specialized in the manufacture of venting, gauging and other tank equipment.

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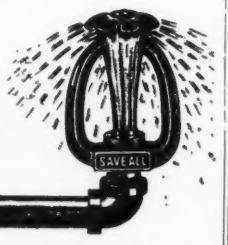

PROOF

OF THE VALUE OF A PROTECTION SYSTEM IS ITS RECORD IN MINIMIZING LOSSES

Proof of the remarkable efficiency of ADT Protection Services in minimizing fire losses is presented in the accompanying record for 1948.

These figures warrant the thoughtful consideration of all individuals and organizations concerned with the protection of property.

Of special significance is the high ratio of immunity from losses, which forcefully demonstrates the consistent, year-to-year effectiveness and value of ADT Protection.

ADT Central Station Services are available in more than 500 municipalities in the United States. Elsewhere the same systems, including all-important inspections, tests and maintenance, are furnished for local operation or with direct-to-fire department connections.

Write for booklet "Protecting Life and Property".

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CENTRAL STATIONS IN ALL PRINCIPAL CITIES OF THE UNITED STATES

ADT

1948 PERFORMANCE

WATCHMAN'S REPORTING AND MANUAL FIRE ALARM SERVICE

Investigations of failures of watchmen to signal Central Stations on schedule	210,379
Total number of signals recorded	356,308,792
Watchmen's patrol efficiency	99 94/100ths %
Alarms from Manual Fire Alarm Boxes	1,460
Insurable values of properties protected	$15,097,547,000
Ratio of losses to insurable values protected	4/100ths of 1%
Fire loss immunity in 1948	$99\frac{96}{100}\%$

AVERAGE FIRE LOSS IMMUNITY DURING PAST TEN YEARS $99\frac{96}{100}\%$

SPRINKLER SUPERVISORY AND WATERFLOW ALARM SERVICE

Supervisory alarms, indicating temporary impairment of sprinkler systems	180,571
Waterflow alarms, caused by fires or serious leaks	3,545
Manual fire alarms	108
Insurable values of properties protected	$8,011,877,000
Ratio of losses to insurable values protected	2/100ths of 1%
Fire loss immunity in 1948	$99\frac{98}{100}\%$

AVERAGE FIRE LOSS IMMUNITY DURING PAST TEN YEARS $99\frac{98}{100}\%$

At Last !

3-inch size shown above

A WATERFLOW SWITCH *with*

INSTANTLY RECYCLING PNEUMATIC RETARD

(No build-up)

Easily set for any period up to one minute.

- **Underwriters' Approved**
- **Paddle of Non-corrodible Monel**
- **Bell Wiring is Only Electrical Connection**
- **Easily Installed in All Sizes From 2½" Up**
- **Eliminates False Alarms due to Water Surges**

Where many waterflow switches are necessary, transmitters can be substituted for the switches, thereby saving enormously on the wiring system as only two wires would be necessary to take care of any number of transmitters. No necessity to reduce number of alarm valves due to cost. Night watch and fire alarm boxes may be installed on same wiring with waterflow transmitter system. Easily installed by merely drilling a one and seven-eighths inch hole in pipe.

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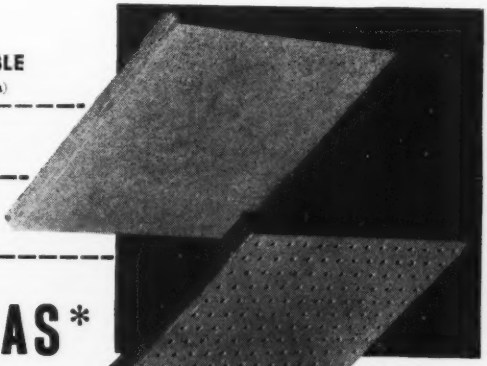
NONCOMBUSTIBLE
(Fed. Spec. SS-A-118a)

EFFICIENT

LIGHT WEIGHT



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Perforated Tile
Also Plain Board
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Write for your copy of the new manual—"Fiberglas Acoustical Materials" —Fiberglas Standards AC6.C1. Owens - Corning Fiberglas Corporation, Dept. 826, Toledo, Ohio. In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

Important Characteristics:

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- ★ High acoustical value
- ★ Light weight
- ★ Dimensionally stable
- ★ Easy maintenance
- ★ Economical—competitively priced
- ★ Ideal for firesafe, mechanically suspended ceilings
- ★ High safety factor in adhesive applications
- ★ Approved applicators in principal cities

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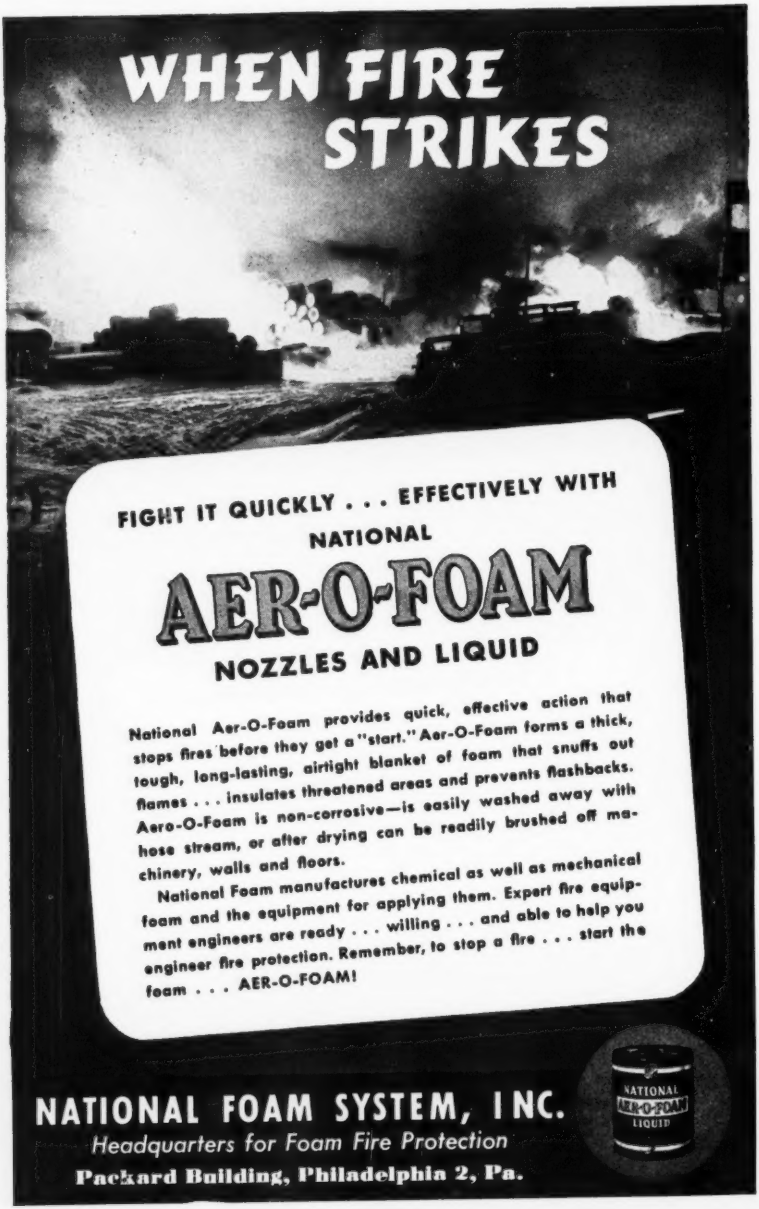
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NOTES FOR THE FIRE CHIEF

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"Gentlemen:

"Fire protection discussions pose only one major question: Do YOU want to stay in business?

"It has been said repeatedly—and deserves to be said again—43% of burned-out businesses never recover—never resume operation—never open their doors again!

"If your buildings are not fully protected from fire right now, you are gambling on the short end of a 5-to-2 bet that you will not be in business next month, maybe next week. Even tonight fire may wipe you out *for good.*

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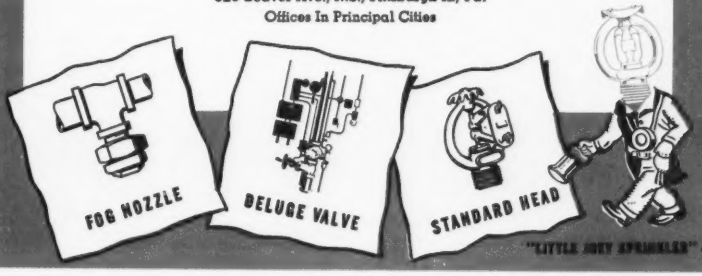
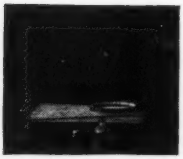


TESTS CONFIRM...



Test structures built of Koppers fire-retardant wood (left) and untreated wood (right) ready for the fire test. Five quarts of kerosene, placed in pans, furnishes fuel for each blaze.

Both structures are quickly enveloped in flame. Treated structure resists fire, but untreated one encourages it, contributes fuel to the fire.

After twenty-two minutes the untreated structure, still burning, is collapsing. Note that in the treated structure, the fire stopped when the fuel burned out.

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Right · The treated structure was charred . . . but retained its integrity and strength, as the 800 pound load shows.

Left · Continued burning reduced the untreated structure to ashes.

Flame tests demonstrate the fire-resistant qualities of TOLEX.

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TOLEX F. R.—certified to be fire-resistant by New York City, Boston and other large communities—is the answer for railroad cars, buses, watercraft—hotels, apartment buildings, department stores—restaurants, bars, theaters—any place where people congregate. And TOLEX goes far beyond that! Its colorful lasting beauty and super-toughness have given it top place with wide-awake industries where such qualities count most. A Textileather* product.

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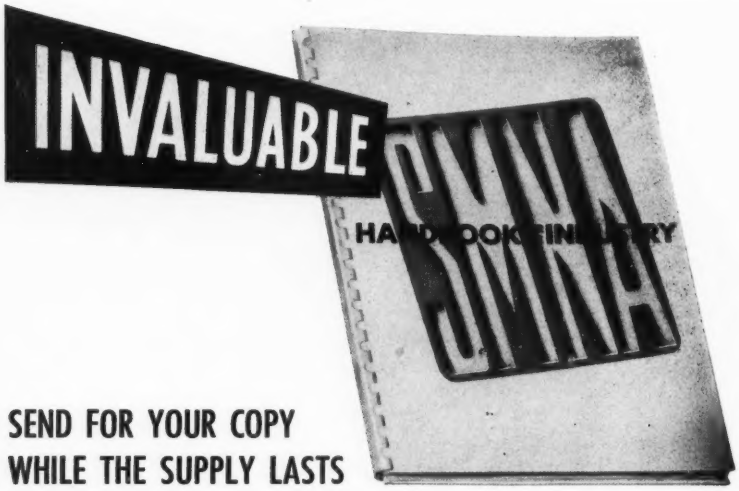

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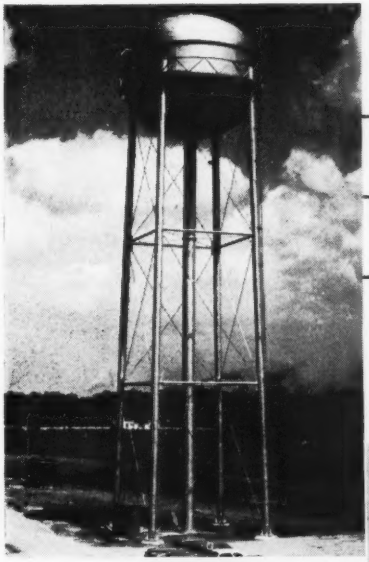

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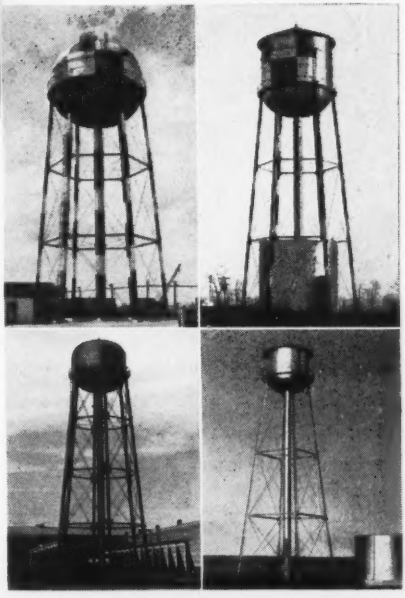

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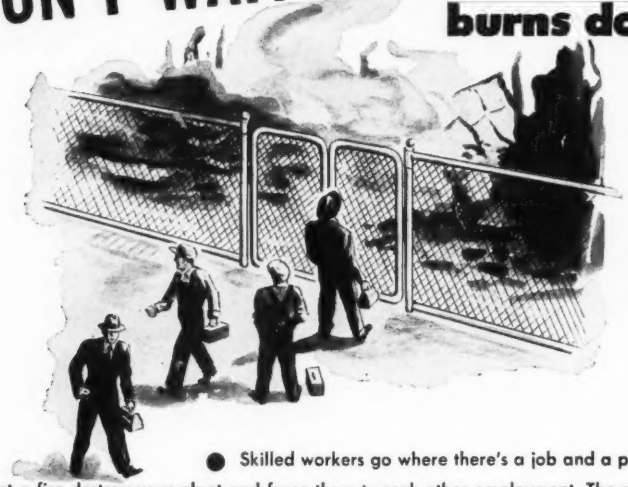
SKILLED WORKERS WON'T WAIT . . . if your plant burns down



● Skilled workers go where there's a job and a pay check. Don't let a fire destroy your plant and force them to seek other employment. The rebuilding of a competent staff can cost you plenty . . . ask your personnel manager.

Safeguard your investment in skilled labor, materials, equipment and buildings by installing modern C-O-Two Fire Protection Equipment. The new C-O-Two Combination Smoke Detecting and Fire Extinguishing System is a 24 hour a day automatic fire watchman. The first whiff of smoke in a protected area sounds an alarm. Then fast, clean, non-damaging carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage.

Whether your fire protection problem is a store, factory, ship or power plant, an expert C-O-Two Fire Protection Engineer can help you plan and install adequate fire protection equipment. Write us today for complete information. Remember fire doesn't wait...act now!

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

RELIABLE

AUTOMATIC SPRINKLER DEVICES

PROTECTING LIFE AND PROPERTY FOR OVER 25 YEARS

Reliable Automatic Sprinkler Devices have an excellent field record . . . superb in design and construction . . . are universally approved by all Fire Insurance and Governmental Authorities . . . and effect maximum reductions in fire insurance premiums.

They comprise a complete line including Automatic and Open Sprinklers, Alarm Valves, Dry Pipe Valves, Accelerators, Circuit Closers, Water Motors and all other accessories required in Sprinkler Systems.

Reliable Systems are protecting thousands of properties throughout the United States, Canada and foreign countries.

FURTHER INFORMATION UPON REQUEST

Manufactured and Distributed by

The Reliable Automatic Sprinkler Co. Inc.

BRONX STREET — MOUNT VERNON N. Y.

EASIER FIRE FIGHTING FOR YOUR EMPLOYEES!

with

Randolph

Trigger-Touch Carbon Dioxide Fire Extinguishers

Your employees are your *real* fire-fighters . . . and the fire extinguisher is their most powerful weapon. That's why it's important that you eliminate cumbersome, antiquated extinguishers . . . provide them with easy-to-use equipment.

Just ONE HAND snaps the Randolph Extinguisher from its bracket . . . one trigger-touch sends clouds of penetrating, snowy carbon dioxide into the fire . . . stops the most stubborn blaze in *split-seconds!*

With no valves or nozzles to adjust, Randolph Extinguishers are PANIC-PROOF — get the employee to the blaze before it spreads. A non-toxic, odorless gas, carbon dioxide does not damage equipment or conduct electricity. It leaves no stain or liquid; will not freeze or deteriorate.

All Sizes . . . Underwriters Approved

Randolph Trigger-Touch Extinguishers are available in 2, 4, 10, 15 and the big 25 lb. size on wheels . . . every unit approved by Underwriters' Laboratories. Mobilize *your* first-aid fire defense now! For complete fire protection facts or test demonstrations, write . . .

RANDOLPH LABORATORIES, INC.

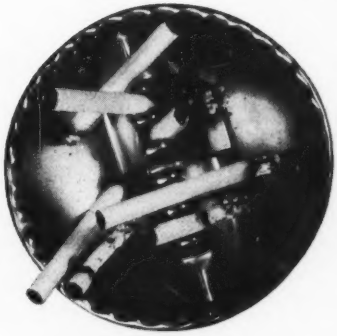
24 E. Kinzie Street

Chicago 11, Illinois

PREVENT FIRES SAVE LIVES | this NEW and SIMPLE way

Buy the "ANHOLT ASHTRAY" made from

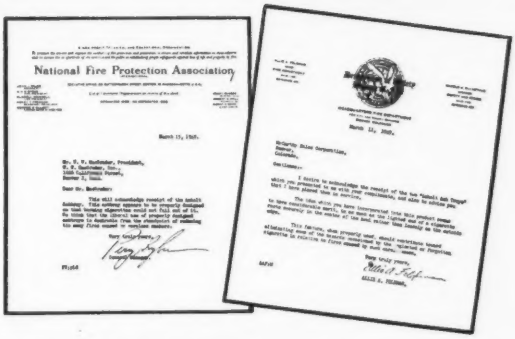
Coors **THERMO PORCELAIN**



Tested **and** ***Proved***
to be America's finest fire-preventive ashtray. For hotels, restaurants, clubs, institutions, hospitals and homes.

Partial List Of Users...

- Brown Palace Hotel, Denver
- William Penn Hotel, Philadelphia
- Hollenden Hotel, Cleveland
- Hotel Book Cadillac, Detroit
- Hotel Roosevelt, New York
- Penn Harris Hotel, Harrisburg, Pa.
- Hotel Vendance, Evansville, Ind.
- Broadwater Beach Hotel, Biloxi, Miss.
- Burlington Railroad (C. B. & Q.)


National Fire Protection Association

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In The Background Till Fire Strikes

Fits in smoothly with the most modern interiors. Barely visible, but ready at a second's warning to spring into action. Viking Flush Type Sprinkler Heads offer great *dependability*, plus true functional design. Get all details today from the *Viking* representative in your neighborhood.

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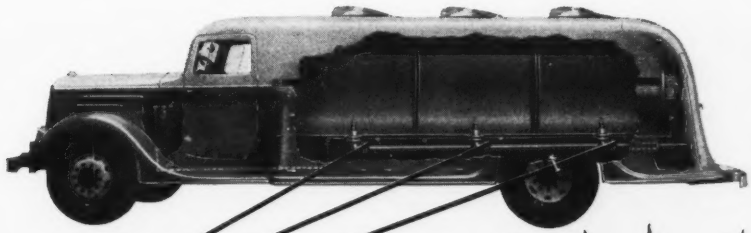
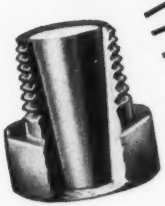
THE VIKING CORPORATION
HASTINGS, MICHIGAN





IN CASE OF FIRE

The little fusible plugs shown above are so small that you can hold a dozen of them in your hand, but in petroleum truck tanks equipped with S.&J. Internal Hydraulic safety valves, they perform a mighty important service. These little fusible plugs are inserted in the hydraulic line at strategic points. When hydraulic pressure is applied, the SAFETY valves open. When the pressure is released the SAFETY valves close under spring tension. Should a fire occur while the valves are open, during unloading operations, the fusible metal in these plugs melts at 165 F.— less than the amount of heat generated by a lighted match —and AUTOMATICALLY releases the hydraulic pressure. The release of pressure AUTOMATICALLY closes all valves which are open. No need for anyone to rush in and try to stop the flow of gasoline manually. It is done AUTOMATICALLY and quickly, without anyone being burned. Yes, hydraulic pressure is positive—that is why the largest marketers and transporters of petroleum products use S.&J. Internal Hydraulic Safety Valves in their truck tanks.

SHAND & JURS CO.

BERKELEY, CALIFORNIA

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SHAND & JURS

REGO
LP GAS EQUIPMENT

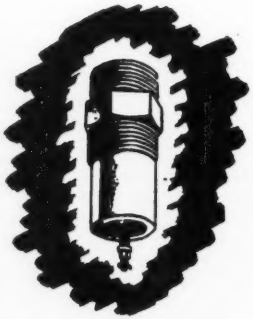
Specified For...

PERFORMANCE PLUS SAFETY!

Here's Why:

- It is listed by Underwriters' Laboratories
- It conforms to N.F.P.A. Standards
- It is manufactured only after thorough field testing
- It is shipped only after being rigidly inspected and tested at the factory

Typical of the many RegO-designed devices for insuring the safe use of LP Gases are RegO Excess Flow Check Valves. These valves, which shut off the flow of fuel should a break in the line occur, may be used with butane or propane in either a gaseous or liquid state. They function with complete efficiency whether mounted vertically or horizontally. A complete range of sizes provides valves suitable for every use, from small domestic installations to large bulk plant or industrial applications.



RegO Excess Flow Check Valves

REGO LP GAS EQUIPMENT

The BASTIAN-BLESSING Company

4201 West Peterson Avenue Chicago 30, Illinois

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING LP GASES

An Unsupervised WATCHMAN is like a school crossing without a Policeman.

IT'S DANGEROUS!

Why risk fire, theft and malicious damage to your plant? Why wonder whether your Watchman is on the job when you can be sure with a

DETEX GUARDSMAN WATCHCLOCK SYSTEM

The GUARDSMAN provides a tamper-proof record of your Watchman's activities every minute of his tour. Gives unbroken, mechanical supervision during long week-ends and plant shut-downs. There's no need for a supervisory employe to return to the plant to change the dial. Quickly pays for itself in permanently reduced insurance premiums. Approved by Underwriters' Laboratories, Inc. and Factory Mutuals Laboratory.

Write today for free folder.

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DETEX WATCHCLOCK CORPORATION
Dept N-4
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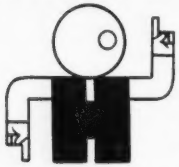
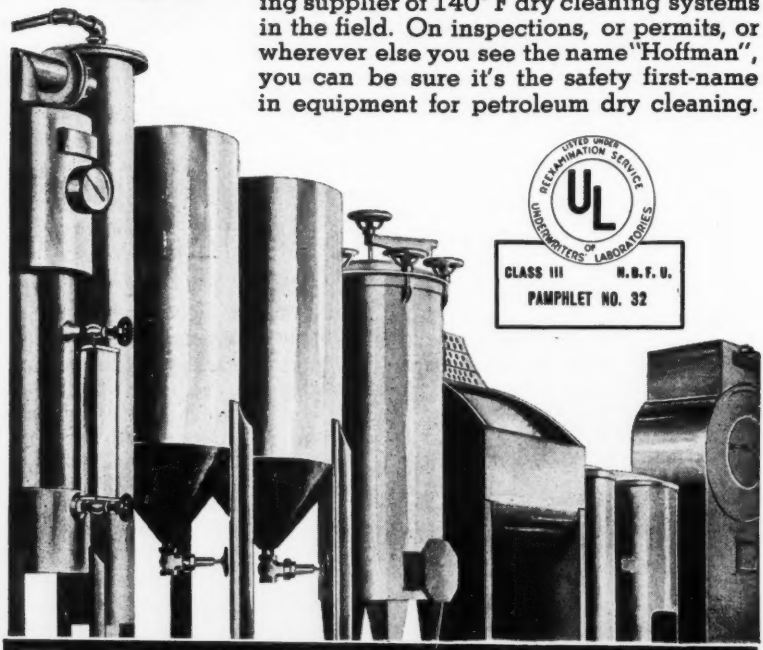
Sales and Service in All Principal Cities

PROVED by a 13-Year CLEAR LOSS RECORD

HOFFMAN 140-F UNITS FOR SAFE DRY CLEANING



Year after year, the safety of commercial dry cleaning with 140° flash-point, petroleum solvent has been proved by Hoffman equipment. Hoffman originated the process in 1935 and, ever since, has been the leading supplier of 140° F dry cleaning systems in the field. On inspections, or permits, or wherever else you see the name "Hoffman", you can be sure it's the safety first-name in equipment for petroleum dry cleaning.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING, LAUNDRY & GARMENT PRESSING EQUIPMENT

FOR
FLAMMABLE LIQUID FIRES
GASOLINE • NAPHTHA
BENZENE • ALCOHOL
LACQUER • VARNISH
PAINT • SOLVENTS • ETC.

PIONEERS OF DRY CHEMICAL
ANSUL
REG. U.S. PAT. OFF.
FIRE EXTINGUISHING EQUIPMENT

DRY CHEMICAL

ANSUL MODEL 30

FIRE EXTINGUISHERS ARE YOUR *BEST* PROTECTION

...and most economical, too! Tests conducted by impartial, nationally recognized approval laboratories have proved the superiority of Ansul Dry Chemical Fire Extinguishers on *Flammable Liquid Fires.*

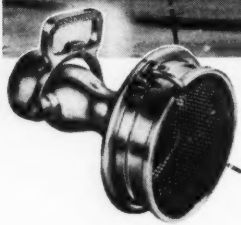
In addition, Ansul Fire Extinguishers provide greater safety for the operator. The stream of Ansul Dry Chemical forms a protective screen safeguarding him against radiant heat.

More and more industrial plants, transportation companies, oil companies, etc. are switching to Ansul Extinguishers as their first line of fire defense. There is a reason.

Get the facts. Send for your copy of File No. 400. You'll also receive our latest literature together with comparative rating charts for the various types of fire extinguishers.

- **Safe for use on electrical fires, tool Even high voltages are not conducted by dry chemical stream.**
- **Can be recharged at scene of fire furnishing continuing protection.**
- **Annual recharging is not necessary. Low maintenance costs.**
- **Longer range stream of dry chemical is effective in winds and drafts.**
- **Ansul Dry Chemical is non-abrasive, non-corrosive, non-toxic.**
- **Listed and Approved by Underwriters Laboratories and Factory Mutual Laboratories.**

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN PRINCIPAL CITIES IN THE UNITED STATES, CANADA, AND OTHER COUNTRIES

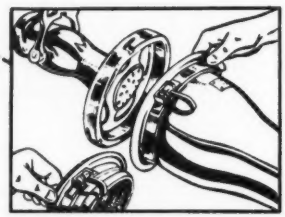


FASTER and MORE ECONOMICAL
EXTINGUISHMENT of GASOLINE FIRES
using ROCKWOOD FogFOAM

Whip gasoline fires with Rockwood's new Type FFF FogFOAM Nozzles and Rockwood Foam Liquid. They offer several advantages over old style, slow-acting *powder* type foam and any other type of liquid foam equipment now on the market.

FogFOAM produced by Rockwood enables you to: (1) use smaller hose lines; (2) bring foam lines into action faster; (3) apply foam directly to surface of burning gasoline; (4) cover large areas of burning gasoline or other flammable liquids faster than with a solid foam stream; (5) put out gasoline fires at *less cost* by using *less foam*; (6) *put out* and *keep out* gasoline fires; (7) protect firemen with *wide, sheltering* discharge of FogFOAM; (8) clean up foam residue following fire more easily and with less effort than possible with old style powder foam.

Write for literature giving more details.



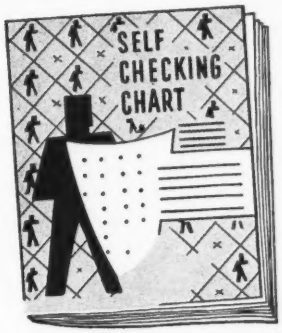
Rockwood's Type FFF Nozzles give you choice of *three* types of discharge: (1) FogFOAM, (2) Solid Foam Stream, or (3) High Velocity WaterFOG. Picture shows quick shift from FogFOAM Screen to Solid Foam Shaper on Rockwood Type FFF Nozzle.

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY

56 HARLOW STREET WORCESTER 5, MASSACHUSETTS

Specialists in Fire Protection Engineering, Equipment and Installation since 1907



another PROTECTOSEAL SERVICE

of interest to professional people engaged in fire prevention

New "Self-Checking Chart"

Protectoseal extends a helping hand to American industry. Free for the asking . . . it's called the "Self-Checking Chart." It is a tool to help plant managers and those responsible for fire safety to make inspections of their property with greater speed and assurance.

Handy Departmental Guide

The "Self-Checking Chart" is a guide that points out places to look for specific hazards. It is a check list of points of danger. Specifically it refers to the handling, storing, and dispensing of flammable liquids, but it is packed with fire-facts and good tips on housekeeping and fire prevention. A complimentary copy will be sent upon request.

Valuable Inspection Service

All facilities of *Protectoseal*, its engineers, its field inspectors, its educational bureau are available (without obligation) to anyone interested in reducing the loss of life and property by fire. Some phases of the *Protectoseal* program — reprints of informative ads, booklets, catalog materials and this new technique for plant inspection — may perhaps be of value in your work. They are all yours free of charge.

THE PROTECTOSEAL COMPANY
1972 SOUTH WESTERN AVENUE, CHICAGO 8, ILLINOIS

Most Durable and Why:

No compromise is made with materials—from the full-jeweled precision watchclock movement to the padded, harness-leather carrying case. But, more than that, CHICAGO Watchclocks are the work of master mechanics—career watchclock craftsmen. Their amazing precision-skill results in an unequalled combination of pin-point accuracy and extreme durability. No wonder famous "name" concerns, all over the world, depend on the CHICAGO Watchclock System.

Got a Watchman?
Then invest about $100* in a 3-way benefit
1 INCREASE your property protection against fire, theft and vandalism by installing the CHICAGO Watchclock System.
2 REDUCE insurance rates and thereby quickly get back the cost of the Chicago Watchclock System.
3 MAKE MONEY permanently So long as you use the Chicago Watchclock System you will continue to save on insurance costs.
CHICAGO WATCHCLOCK System
Puts Pep in the Step of Watchmen
Send for this illustrated folder. Shows how you install system with no tools other than a screwdriver!
*Approximate cost of system
CHICAGO WATCHCLOCK
Division of GREAT LAKES INDUSTRIES, Inc.
The First—and Still the First

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Offices in Principal Cities

The CHICAGO System

quickly pays for itself by reducing insurance rates. . . .
APPROVED BY UNDERWRITERS' LABORATORIES, INC.,
and FACTORY MUTUAL LABORATORIES.

Send for new, illustrated folder today!

When you think of CO_2 . . . call *Kidde*!

*Kidde** CO_2 fire-extinguishing equipment includes hand portables, wheeled units, hose racks and reels, built-in systems, automatically or manually operated, for total flooding or local application.

**Also known as "LUX"*

Walter Kidde & Company, Inc.
451 Main St., Belleville 9, N. J.

Kidde

The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

No. 2, – MR. INSPECTOR: This is the second of a series showing the various types of panic exit devices — a series designed to help you show people how panic devices look and operate. This illustration shows two single door rim type devices and a removable mullion installed in a double door opening. An ideal installation for wide openings.

VON DUPRIN DIVISION
VONNEGUT HARDWARE CO., INDIANAPOLIS 9, INDIANA
In Canada, write Yale & Towne Mfg. Co.
(Canadian Div.), St. Catharines, Ont.

Kinnear Rolling Fire Doors

Famous "Akbar" Doors cut off drafts... defy flames... block spread of fire at all openings

These fireproof all-steel doors do a *thorough* job of blocking off flame spreading drafts.

YOU'RE SAFER with the *automatic* fire protection of "Akbar" Rolling Fire Doors! Fireproof all-steel doors are out of the way, overhead, when not in use. But when fire threatens, they promptly seal off doorways, windows and corridors.

Positive enclosure is certain because the doors are *pushed* downward automatically, by strong auxiliary springs. A special safety device controls their downward speed, guarding against personal injury and reducing impact force on the floor.

For emergency exit, the doors can be raised after automatic closure. They will then close again, quickly and automatically.

Tested and labeled by Underwriters' Laboratories Inc., Akbar Fire Doors often save enough in reducing insurance rates to pay for themselves in two or three years. Built to fit doorways, windows and other openings of any size, they can be equipped to fit regular, daily service use, with or without motor operation. For service use only, standard "non-labeled" Kinnear Rolling Doors are preferred. Write for details.

Saving Ways in Doorways

KINNEAR
ROLLING DOORS

The KINNEAR Manufacturing Co.
Factories: 2250-70 Fields Ave., Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, California
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"Automatic" Sprinklers . . . A Vital Business Economy for Industry the World Over

ARE you in a position to definitely measure the over-all cost of destruction, should fire reduce your plant or property to a shambles of twisted steel or broken concrete? We doubt it, for fire loss represents considerably more than is visible in the destruction of buildings, equipment and records. It means the interruption of production and service, the reduction of assets and increased liabilities. It means temporary and perhaps permanent loss of customers. In short, it could well mean the financial ruin of your entire business enterprise.

On the brighter side of this picture of fire destruction stand "Automatic" Sprinklers, industry's most effective weapon against fire. For, "Automatic" Sprinkler systems are super-sensitive to the very indication of flame. They make the fire extinguish itself, even before it can make headway. And, on the financial side, "Automatic" Sprinklers, like any other capital asset, can be amortized over a given period of years, with their initial cost ultimately taken as an operating expense.

You and every other executive with an appreciation of business economy must not overlook the importance of fire safety with "Automatic" Sprinklers, *an important investment today . . . perhaps welcomed protection tomorrow.*

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FOR INVESTMENT PROTECTION
DEVELOPMENT · ENGINEERING MANUFACTURE · INSTALLATION

WHY CITIES PREFER GAMEWELL

2 Reasons are—Economy and Dependability

Many Gamewell fire alarm boxes still in use have service records exceeding 70 years, and — Obsolescence, due to the production of later models affording greater protection, not deterioration, is generally the cause of retiring Gamewell boxes from service.

Gamewell Three-Fold Fire Alarm Box

The Standard for Municipal Service

For the protection of the values at risk — human life, property, business and income — adequate fire alarm box distribution is a sound investment.

THE GAMEWELL COMPANY

Newton Upper Falls 64 - Massachusetts

FIRE PROTECTION

where APPEARANCE counts

The new Grinnell Quartzoid Ceiling Sprinkler meets the increasing demand by discriminating clients for an inconspicuous sprinkler head that blends with present day trends in interior decoration. All piping is hidden above the plaster or acoustic panels. The head protrudes but 1″ below the ceiling yet provides coverage for both ceiling and floor areas. It operates at 135°.

Complete information is available for the asking from any of our offices throughout the country. Grinnell Company, Inc., Providence 1, R. I.

GRINNELL SYSTEMS

Protection Against Fire